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THIRTY-SIXTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

The thirty-sixth meeting of the Society was held on invitation of Miss Margaret Harwood at the Maria Mitchell Observatory at Nantucket, Massachusetts, from September 7 to 10, 1926. Most of the members arrived by steamboat from New Bedford on Tuesday afternoon or evening, enjoying a delightful sail of fifty miles across Buzzards' Bay, Vineyard Sound, and Nantucket Sound. The Ocean House, in the center of the quaint old Nantucket town, was the hotel quarters. The meetings of the Society were held in the library of the observatory, about ten minutes walk from the hotel. On Tuesday evening there was an informal gathering in the parlors of the Ocean House.

Sessions for papers were held at 9 and 2 o'clock on Wednesday. At 11 o'clock the Society adjourned to the bathing beach. A few tried the water, but the majority were content with a sun bath. From 4 to 6 o'clock the Society enjoyed the hospitality of the Maria Mitchell Association at the Nantucket Yacht Club. Tea was served in the club house and on the lawn, overlooking the harbor. In the evening Professor Henry Norris Russell gave a public lecture in the Unitarian Church, taking as his subject, "Is there life in other worlds?" The big church was packed to the limit and all were much interested in Professor Russell's presentation of the subject.

On Thursday there were the usual sessions for papers and the 11 o'clock swim. In the afternoon the members were taken on a drive around the island in motor busses; across the moors to Surf Side on the south shore, to the Radio Compass Station, through Siasconsett to Sankaty Head and its great lighthouse, and, finally, to Wauwinet, at the east end of the island. At the Wauwinet Hotel a typical Nantucket "shore dinner" was served.

On Friday morning there was the final session for papers and the election of officers. A sail was on the program for the afternoon, but a brief shower in the morning dampened the ardor of most of the members and many took the 1 o'clock steamer to New Bedford instead of the sail around Nantucket.

Between sessions the members took the opportunity to visit the observatory, the Maria Mitchell house; the Historical Society's Rooms, filled with relics of the sea; Moor's End, a house and garden typical of the old whaling days; and many other points of interest in the town.

The Nantucket meeting was one of the largest on record, more than one hundred and twenty members and guests being present. It was also one of the most successful, both from an astronomical and from a social point of view.

At the last session there were elected as officers those whose terms in the following list begin in 1926, others continue to serve unexpired terms. Professor Frederick Slocum acted as secretary for the Nantucket meeting.

President	George C. Comstock	1925-1928
Vice-Presidents	S. A. Mitchell	1925-1927
	A. O. Leuschner	1926-1928
Secretary	Joel Stebbins	1926-1927
Treasurer	Benjamin Boss	1926-1927
Councilors	W. J. Hussey	1924-1927
	Harlow Shapley	1924-1927
	H. C. Wilson	1925-1928
	W. H. Wright	1925-1928
	C. E. K. Mees	1926-1929
	E. C. Slipher	1926-1929
Ex-Presidents	Frank Schlesinger	
	W. W. Campbell	

Members of the Division of Physical Sciences, National Research Council:

Harlow Shapley	1924-1927
Joel Stebbins	1925-1928
C. G. Abbot	1926-1929
Frank Schlesinger	1927-1930

The following persons were elected to membership, making a total of four hundred and thirty-seven in the Society:

Adelaide Ames, Harvard College Observatory, Cambridge, Mass.

L. B. Andrews, Astronomical Laboratory, Cambridge, Mass.

Claude W. Bruce, Astronomical Laboratory, Cambridge, Mass.

Theodore Dunham, Jr., 29 Shaler Lane, Cambridge, Mass.

G. Clyde Fisher, American Museum of Natural History, 77th St. West, New York City.

H. W. Geromanos, P. O. Box 1414, Boston, Mass.

S. Lynn Rhorer, 26 Luckie St., Atlanta, Ga.

Jan Schilt, Yale University Observatory, New Haven, Conn.

Sinclair Smith, Mt. Wilson Observatory, Pasadena, Calif.

Ch'ing-Sung Yü, Lick Observatory, Mt. Hamilton, Calif.

Members of the Society present at the Nantucket meeting were:

C. G. Abbot	Alice H. Farnsworth	J. A. Miller
S. Albrecht	E. A. Fath	J. J. Nassau
Leah B. Allen	J. W. Fecker	J. Pawling
Adelaide Ames	C. Fisher	Cecilia H. Payne
L. B. Andrews	H. W. Geromanos	J. H. Pitman
W. Arnold	A. Estelle Glancy	C. L. Poor
S. I. Bailey	Margaret Harwood	H. N. Russell
Ida Barney	M. Alberta Hawes	F. H. Safford
L. A. Bauer	W. Henry	J. Schilt
Harriet W. Bigelow	Laura E. Hill	H. Shapley
S. L. Boothroyd	Helen E. Howarth	Lois T. Slocum
B. Boss	H. E. Ives	F. Slocum
E. W. Brown	Grace C. Jordan	B. W. Sitterly
Hazel M. Burton	E. S. King	C. L. Stearns
L. Campbell	L. V. King	H. T. Stetson
F. E. Carr	Eleanor A. Lamson	R. M. Stewart
C. A. Chant	Isabel Lange	J. Stokley
G. C. Comstock	F. C. Leonard	Helen M. Swartz
J. H. Darling	F. H. Loud	F. D. Urie
P. Davidovich	E. S. Manson	W. R. Warner
T. Dunham, Jr.	D. B. McLaughlin	E. L. Williams
W. S. Eichelberger	Antonia C. Maury	R. E. Wilson
C. W. Elmer	W. I. Milham	M. L. Zimmer

It was announced that the Society will meet with the A. A. A. S. at Philadelphia in December, 1926, and that the 1927 summer meeting will be held in the Middle West.

ABSTRACTS OF PAPERS

THE VARIATION OF THE SUN AND ITS CONSEQUENCES.

By C. G. Abbot.

By selecting days of equal atmospheric conditions (see *Monthly Weather Review,* May, 1926), the author has devised a new method of confirming the results on solar variation hitherto depending on "solar constant" determinations alone. For under such equal atmospheric conditions pyrheliometry of total solar radiation is competent to show solar variation without allowance for atmospheric absorption. Twelve figures were shown giving comparisons between the new and old methods for the twelve months and years 1920 to 1926 at Montezuma (Chile) Station. The average deviation is approximately 0.2 per cent, and the range of variation shown about 3 per cent. Similar results were given for Mount Wilson observations of July 1910 to 1920.

Various correlations of high order have come out recently, as between yearly solar radiation and terrestrial magnetism variations (Bauer) 97 per cent; monthly solar variation and ultra-violet solar variation (Pettit) over 80 per cent; solar variation and numerous pressure and temperature meteorological relations (Clayton) 50 to 90 per cent.

It is not to be expected that great increase of range in forecasting meteorological conditions from solar variation will be possible without excellent solar observations continued over a considerable term of years. The Smithsonian Institution maintains stations in California and Chile. A third station is now being established in Southwest Africa under a grant from the National Geographic Society. Observations will begin probably in October, 1926. Funds are available to continue them only until the year 1930. It would be extremely desirable to continue this station much longer, and to add a fourth cooperating station in North Africa or Baluchistan if funds were found for it. The installation costs about twenty thousand dollars and the yearly upkeep about eight thousand dollars.

ON CONVECTION CURRENTS IN CLASS-B STARS.

By Sebastian Albrecht.

By convection currents, as here used, are meant simply bodily movements of the gases in which the absorption lines originate. An enormous amount of energy is being radiated outward in B-type stars, and it is conceivable that this process may be accompanied by actual movements of gases on a large scale. I shall not discuss the causes of such currents—which may include high temperature gradients and perhaps electrical and radiation fields—but shall merely present such observational evidence as is available bearing on their presence or absence in the atmospheres of the B-type stars.

Convection currents in stellar atmospheres may be general in the sense that they are shared alike by all of the gases represented in the absorption spectrum, or, they may be selective and different for different gases, most probably associated with differences of level. General currents would produce bodily displacements of all of the absorption lines and their effects would thus be merged in the observed radial velocities of the stars, and would become a component part of the K-term obtained in connection with a solution for solar motion. In a recent paper I attempted to evaluate this component of the K-term. By process of elimination, after approximating other factors involved, it was found that general downward currents were confined within 2 km/sec. as an upper limit, with a fair possibility that they may be practically zero. General upward currents of these gases seem excluded perhaps from certain general considerations but more particularly because such upward currents, producing displacements of opposite sign from that of the K-term, would seem to require very improbable high values for other factors—especially for the relativity displacement.

Selective convection currents, *i. e.* those shared unequally by different gases, would produce different displacements for the lines of the different elements involved, and would show up as systematically displaced radial velocities or derived wave-lengths. From published and

unpublished measures of 174 three-prism spectrograms of 24 helium stars represented by 231 separate plate measurements by Frost and Adams, I have obtained new wave-lengths for 58 lines occurring in types B0 to B8. These wave-lengths supply the data which are necessary for a discussion of selective convection currents.

To summarize briefly, it was found that when the differences observed minus normal, *i. e.* stellar minus observed wave-lengths, were formed, no relative displacement was shown between the metallic and the non-metallic lines. From a close inspection of the details it appeared very probable that the moderate relative difference of 0.019 A between two groups of non-metallic lines represents systematic errors in the normal wave-lengths rather than real relative motions. On the whole, the evidence furnished by these wave-lengths is not especially favorable to the existence of large general inward motions of the gases in which the absorption lines of B-type stars originate.

RECENT SOLAR AND MAGNETIC ACTIVITY.

By Louis A. Bauer.

Supplementing the author's paper at the Rochester meeting of this Society last January, an account was given of the results of additional studies and of some arrangements made for the proposed international and concomitant solar and magnetic observations. A set of magnetic instruments for both visual and photographic records of magnetic storms, as furnished by the Department of Terrestrial Magnetism of the Carnegie Institution, is being installed at the Mount Wilson Observatory. These records are designed either to give notification at this Observatory or elsewhere, for the making of intensive measures of solar activity with all available appliances, or to be used for correlative studies with solar phenomena, observed prior to the advent of the magnetic storm. Thus with the combined aid of the magnetoscope, and of the spectrohelioscope, spectroheliograph, and other means of observing solar phenomena, we may possibly, in the course of time, obtain a clearer perception than we now have of the relationship between solar and magnetic activity.

Another promising line of investigation is correlative studies of magnetic storms and radio-reception measurements. Data regarding solar and magnetic disturbances are being regularly supplied, by various institutions, to those interested in radio work. Reports received thus far during the past eight months of marked solar and magnetic activity indicate on the average a closer relationship for short intervals, such as a week, between radio-reception and activity of the earth's magnetism than with activity of the sun as at present measured. Thus we once again have indications of the fact, already mentioned in the author's previous paper, that the available solar observations do not yet afford us the desired measures for satisfactory correlations with various

terrestrial phenomena. Perhaps it may turn out that because of the earth's action as a great magnet and because of the electrical changes in its upper atmosphere, we have evidence of radiations from the sun which other means fail to record.

ON THE CORRECTIONS TO THE DECLINATIONS OF THE PRELIMINARY GENERAL CATALOGUE.

By Benjamin Boss and Heroy Jenkins.

The declinations of the stars observed at Albany and San Luis afford an excellent test of the declination system of the Preliminary General Catalogue, due to the fact that a zone of 90° has been observed in common at both stations with the same instrument and mainly by the same observers.

Errors of observation may be attributed to uncorrected refraction and flexure and to personalities which most probably simulate those terms.

Refraction corrections follow the tangent of the zenith distance and higher powers of the tangent; flexure follows the sine of the zenith distance. Solutions were made, employing these terms, over the arc of 90° common to both series of observations.

The results show splendid agreement. Comparison with Raymond's recent determination of the systematic corrections to the declination system of the Preliminary General Catalogue indicates a somewhat greater correction to the declinations, and a consequently greater increase to corrections to proper-motions derived from his treatment.

The evidence points to a very appreciable deviation from the Pulkova refractions for the San Luis station, which is at an altitude of 800 meters and in a comparatively dry climate.

PROGRESS ON THE ORBIT OF THE EIGHTH SATELLITE OF JUPITER.

By Ernest W. Brown.

It was stated that the terms depending only on the ratio of the mean motions of the satellite and Jupiter and the eccentricity of the satellite had been completed. These results also contain the principal terms dependent on the inclination but independent of the node. The portions dependent on the latter are troublesome on account of a long-period term of the fourth order having a very small divisor on integrating the equations. A method has, however, been devised to compute this term, and there seems to be no reason why the orbit should not be computed with an accuracy sufficient to give the Jovi-centric longitude within two or three minutes of arc.

A SEVENTEEN-YEAR PERIOD FOR V HYDRAE, *104620.*

By Leon Campbell.

A recent attempt to analyze the light-curve of the long-period variable, V Hydrae, reveals the existence of a seventeen-year period besides that of the fairly regular period of 532 days. Chandler assigned a provisional period of 535 days, but later abandoned it and considered the star as of the regular class.

Although the range within the period of 532 days is little in excess of two magnitudes, the range within the seventeen-year period is about six magnitudes. Many of the observed curves, especially in recent years when the star has been under closer scrutiny, indicate a tendency to a secondary minimum about one hundred days before principal maximum, although this is not always well marked.

Well observed deep minima occurred in 1908 and 1925, and the earlier material, though meagre, indicates the existence of a similar minimum in 1891. The star is difficult to observe on account of its extreme redness, rivalling S Cephei and R Leporis in color, as well as being rather far south for northern observers. The reality of the seventeen-year period is more clearly indicated in the recent observations, partly because of the closer co-operation between observers in both hemispheres.

This is the first long-period variable which has revealed the existence of such a long term, in addition to the term usually indicated, although a few of the so-called irregular variables have been suspected of having such variations.

THE VELOCITY-CURVES OF 12 LACERTAE.

By William H. Christie.

One hundred and ninety-five spectra of the short-period, variable-velocity star 12 Lacertae have been measured. These include two series taken by Dr. Young in 1922 and 1923, and five series by the writer in 1924 and 1925. The last of the 1924 series, consisting of 76 spectra taken in succession and covering two complete cycles, indicates that the change in amplitude, previously noted by Young, is rapid. The velocity derived from the calcium lines is in close agreement with the reflex of the solar motion, being —14.1 km/sec., whereas the solar component is —11.0 km/sec.

THE ORBITS OF THREE SPECTROSCOPIC BINARIES.

By William H. Christie.

The binary character of the star H. R. 6506 was discovered from eyepiece estimates of early plates by Dr. R. K. Young and was subsequently handed over by him to the writer for measurement and investi-

gation. Thirty-five plates obtained in 1923, 1924, and 1925 formed the basis for a least-squares solution for the most probable values of the orbital elements which are:

$$\begin{aligned} P &= 5.9182 \text{ days} \\ e &= 0.031 \pm 0.016 \\ \omega &= 35°.74 \pm 5°.33 \\ \gamma &= 22.73 \text{ km/sec.} \pm 0.14 \text{ km/sec.} \\ K &= 25.09 \text{ km/sec.} \pm 0.38 \text{ km/sec.} \\ T &= 2.423,585.527 \pm 0.064 \text{ days} \\ a \sin i &= 2,041,000 \text{ km} \\ m_2^3 \sin^3 i/(m_1+m_2)^2 &= 0.00970 \odot \end{aligned}$$

The star H. R. 5752 was discovered to be a spectroscopic binary by the writer and announced as such in the *Journal of the Royal Astronomical Society of Canada*.. Forty-one spectrograms form the basis for the solution of the elements of this binary, γ, K, and (T) being alone solved for. The elements are:

$$\begin{aligned} P &= 1.0085 \text{ days} \\ e &= 0.00 \text{ (assumed)} \\ \gamma &= -17.04 \text{ km/sec.} \pm 0.26 \text{ km/sec.} \\ K &= 11.37 \text{ km/sec.} \pm 0.39 \text{ km/sec.} \\ (T) &= 2,423,112.161 \pm 0.005 \text{ days} \\ a \sin i &= 157,700 \text{ km} \end{aligned}$$

The star H. R. 5702 was discovered to be a spectroscopic binary by the writer in 1924 and its orbital elements have been determined this summer. Twenty-nine measures give the data from which these elements have been determined. The elements are:

$$\begin{aligned} P &= 3.5753 \text{ days} \\ e &= 0.079 \pm 0.022 \\ \omega &= 24°.86 \pm 14°.61 \\ \gamma &= -25.85 \text{ km/sec.} \pm 0.794 \text{ km/sec.} \\ K &= 58.63 \text{ km/sec.} \pm 1.086 \text{ km/sec.} \\ T &= 2.423.211.641 \pm 0.143 \text{ days} \\ a \sin i &= 2,874,000 \text{ km} \\ m_2^3 \sin^3 i/(m_1+m_2)^2 &= 0.0754 \odot \end{aligned}$$

NOTES ON THE SPECTRA OF NOVAE.

By Paul Davidovich.

A preliminary study of the pre-maximum spectra of several novae has been made by the writer in connection with the investigation of Nova Pictoris. As described in *Harvard Circulars* 289 and 295, Nova Pictoris displayed before maximum light an absorption spectrum characteristic of super-giant stars. Pre-maximum spectra of Nova Persei 1901, Nova Geminorum 1912, Nova Aquilae 1918, and Nova Cygni 1920, are available at Harvard, and these stars all display characteristic super-giant spectra.

In spectral class the different novae have the considerable range from B to F5. The earliest type shown by any nova is displayed by Nova Persei, resembling Class B; the latest by Nova Pictoris, Class F5. Nova

Aquilae is Class cA2, Nova Cygni about cA6, and Nova Geminorum cF.

A detailed investigation of the spectral changes of a nova as it approaches maximum light is of great importance in the interpretation of the phenomena of new stars. Spectra obtained in the immediate vicinity of maximum light are available at Harvard for Nova Persei, Nova Geminorum, and Nova Cygni, as well as for Nova Pictoris. A very pronounced feature of the spectra of Nova Persei and Nova Cygni at the pre-maximum stage is the conspicuous increase of intensity of the H and K lines of ionized calcium as maximum is approached. Nova Geminorum, according to the detailed study by Stratton, showed at the time of maximum light a spectrum of later spectral class than that displayed before maximum was reached. The changes in Nova Pictoris are not so definite, owing, presumably, to the comparative slowness of all the changes in that star.

The observed changes in the pre-maximum spectra of novae suggest a decrease in the temperature or in the density of a nova as it approaches maximum light. Presumably, the two processes go on simultaneously and are possibly interdependent, the decrease of the temperature being produced by the decrease of the density of the nova as it rises to maximum. If an expansion, as suggested for Nova Pictoris, indeed takes place, the decrease of density which it must produce will be followed by a decrease of surface temperature. It is quite possible that the strong intensification of the H and K absorption lines, which is shown by several novae while they are approaching their climax of light, is the result of this cooling effect.

Spectra of Nova Pictoris taken in 1926 with the 13-inch Boyden telescope at Arequipa have recently been received at Cambridge. The latest spectrum so far received is dated June 11. Important changes have taken place since December, 1925. The metallic emission has faded away, and the nebular bands have appeared, as well as the group 4640 and the ionized helium line 4686. Hydrogen emission is the most intense, and the nebular lines at 3868 and 4363, as well as the He+ line at 4686, are also very bright. However, the nebular lines at 4959 and 5007 are weak. The continuous spectrum has become considerably fainter as compared with the emission lines. The appearance of the nebular bands and of the 4640 group (although unusually late) shows that Nova Pictoris follows the normal course of development for a new star, although its spectral changes are unusuaally slow.

POPULAR ASTRONOMICAL EDUCATION IN EUROPE AND AMERICA.

By G. Clyde Fisher.

The writer stated the belief that much more is being done in Europe to interest and instruct the general public in astronomy than in America. In justification of this statement were described some of the agencies responsible for the work abroad. First the Uranias, or popular

observatories in which the people may observe on any clear night celestial objects through a fair-sized telescope. Particular note was made of the Urania in Vienna and the one in Zürich. Second, astronomical museums or astronomical departments in museums, especially the Science Museum at South Kensington in London, the little astronomical museum in the Vatican Observatory in Rome, the museum of physics in Florence, and greatest of all, the astronomical department of the German Museum in Munich.

In the last-mentioned museum there are many pieces of apparatus which simply fascinate the visitor. Among these should be mentioned the following:

A Ptolemaic planetarium in a spherical glass globe six feet in diameter, with constellations shown on glass sphere—the earth stationary in the center and the sun, moon, and the planets known at the time this theory prevailed, revolving about the earth, each planet on its epicycle. There is a crank on the outside of the sphere with which visitors may turn the whole apparatus—an excellent mechanism.

A Copernican planetarium of the same size, with constellations on the glass sphere, the sun in the center, with all eight planets with their satellites, all geared properly, revolving around it. A crank on the outside for turning the apparatus completes this excellent mechanism.

The feature of the crank on the outside of these pieces of apparatus, which can be turned by the visitor, adds greatly to his interest and understanding. A similar crank was to be found attached to an apparatus for showing the phases of the moon.

Another Copernican planetarium, without doubt the largest and best in the world. A lighted globe in the center represents the sun. The six planets nearest the sun with their satellites, the planets and satellites all revolving at their proper relative speeds, are shown. The diameter of Saturn's orbit is twelve meters. Uranus and Neptune are left out, presumably because their tremendous distances would make the rest so small proportionately. There is no light except from the central sun, and the walls, ceiling and floor are painted black. Consequently, day and night are well shown on any of the six planets, and our moon goes through its phases with realistic clearness. For the observer or for the demonstrator, a car travels around under the earth, which goes around the sun in twelve minutes, the apparatus being propelled by an electric motor. A periscope makes it possible to see the phases of Mercury and Venus on the plane of the ecliptic. Constellations of the Zodiac are shown in a belt on the wall, with their names in white letters and with the degrees of the circle marked. The stars are shown by lights back of small, round holes in the black wall.

Most impressive and consequently the most popular piece of apparatus in the German Museum of Munich is the new Carl Zeiss projection planetarium. To examine this invention was the chief object of my astronomical mission to Europe in 1925. Since the first one was built

and installed in Munich, several others have been put into operation in other cities in Germany.

The planetarium is placed in a hemispherical dome, white inside and without pillars or posts. The optical projection apparatus is a kind of glorified and animated stereopticon which throws on the inside of the dome images of the sun, moon, all the planets which are visible to the naked eye, and the 4,500 fixed stars that are visible to the naked eye, and also the Milky Way. These projected images move as the real bodies appear to move in the sky, with the time accelerated due to rotation of parts of the central apparatus, which is so accurately made that it takes care of the precession of the equinoxes. The erratic motions of the planets are clearly and satisfactorily shown. The realistic appearance of the fixed stars, including the Milky Way and the illusion of the immensity of space are perfect. One feels that he is in the great outdoors under a clear night sky. By means of a special set of projectors, the names of the constellations can be shown in the sky and with an electric flashlight with an arrow-shaped light the lecturer can point out any star, planet or other body in the sky.

A more complete description of the Carl Zeiss projection planetarium may be found in an illustrated article on the subject by the writer in the July-August, 1926, number of *Natural History*.

On account of lack of time, the remarks on popular astronomy in America were limited to a description of the proposed Hall of Astronomy which has been projected for the American Museum of Natural History in New York City.

The Astronomy Hall is to be located in the exact center of the system of exhibition buildings,—"the celestial hub, so to speak, from which all the halls containing terrestrial exhibits will radiate. Natural History must begin with astronomy, the earth being but one of the heavenly bodies, and a somewhat insignificant one at that."

The building is to be octagonally-shaped with a diameter of 126 feet and a height of five stories, surmounted by a dome. A more complete description of this building and its equipment will be found in an illustrated article entitled "An Ideal Astronomic Hall," by Howard Russell Butler, who was adviser to the architects, published in the July-August, 1926, number of *Natural History*.

THE ORBITS OF TWO A-TYPE SPECTROSCOPIC BINARIES.

By W. E. Harper.

These two stars afford marked contrasts in several particulars. The star H. R. 4750, type A3, has numerous sharp lines for measurement, whilst Boss 5579, type A0, has only a few wide lines, principally the hydrogen series and the calcium K-line. The first star shows only the one set of spectrum lines; in the second both component spectra of nearly equal intensity are recorded. In this latter case the hydrogen

lines are too broad to be well resolved with single-prism dispersion; consequently the resulting velocities are almost wholly dependent upon the K-line. The probable error of a plate is thus necessarily high, being approximately 10 km/sec. for each component, whilst in the case of the single line star, H. R. 4750, the relatively small probable error of 1.2 km/sec. is obtained. Finally a great deal of time was spent upon the double-lined star before the correct period was obtained; that for the single-lined one revealed its period right at the start.

The elements from least-squares solution follow:

H. R. 4750

P = 11.782 days ± .024 days
e = .060 ± .015
ω = 198°.50 ± 20°.40
γ = +1.79 km/sec. ± .37 km/sec.
K = 41.27 km/sec. ± .60 km/sec.
T = J. D. 2,424,585.282 ± .622 days
$a \sin i$ = 6,674,300 km

Boss 5579

P = 1.72897 days ± .00001 days (estimated)
e = .033 ± .017
ω_1 = 256°.0 ± 1°.3
ω_2 = 76.0 ± 1.3
γ = −25.47 km/sec. ± 1.44 km/sec.
K_1 = 109.70 km/sec. ± 2.48 km/sec.
K_2 = 110.35 km/sec. ± 2.55 km/sec.
T = J. D. 2,421,774.161
$a_1 \sin i$ = 2,606,800 km
$a_2 \sin i$ = 2,622,100 km
$m_1 \sin^3 i$ = 0.96 ⊙
$m_2 \sin^3 i$ = 0.95 ⊙

VARIATIONS IN THE LIGHT OF EROS IN 1924.

By Margaret Harwood.

A new period has been found for the variability of Eros (433) during the opposition of 1924. Hitherto, whenever variations in the light of this asteroid have been studied, they have usually followed the double period $0^d.2196$, although the range has varied from 0.0 to 1.5 magnitudes. While at the Mount Wilson Observatory in 1924, the writer made photographs of Eros on four nights: January 4, 5, and 8, and February 10. The asteroid then moved too far south for further observations at Mount Wilson, but in April and in early May photographs were obtained at the Harvard Observatory at Arequipa. The North Polar Sequence was used for comparison stars on the Mount Wilson plates, one of the Harvard Standard Sequences, E5, was used on the Arequipa plates; this precludes the possibility of any variable comparison stars. The period is approximately $0^d.1988$. The observations of May 1 do not give as regular a curve as do those of January 4, 5, and 8, but the period is apparently the same. The measures of the plates made in February and on April 9 indicate periods: $0^d.1986$ and

0d.1989, respectively. A plotting of the residuals in time against the number of periods shows a possible wobbling of the period. Whether this is real can only be proved if observations on intervening dates should be obtainable.

THE ORBIT OF κ DRACONIS.

By S. N. Hill.

Thirty-eight spectrograms of this B-type spectroscopic binary obtained at Victoria with the single-prism camera and fine-grained plates give a period entirely different from that obtained by Baker and published in the *Publications of the Observatory, University of Michigan,* Vol. **3**, 1923. The final elements as derived from the Victoria observations are as follows:

$$
\begin{aligned}
P &= 0.89038 \text{ days} \\
e &= 0.186 \pm .020 \\
\omega &= 284°.47 \pm 6°.70 \\
\gamma &= -11.43 \text{ km/sec.} \pm 0.28 \text{ km/sec.} \\
K &= 18.87 \text{ km/sec.} \pm 0.43 \text{ km/sec.} \\
a \sin i &= 227{,}000 \text{ km}
\end{aligned}
$$

The probable error of a plate is ± 1.7 km/sec.

These elements also satisfy eleven observations taken at Yerkes in the years 1902 to 1925.

DO WE LIVE IN A NEBULA?

By Edward S. King.

The values for space-absorption, found in *Harvard Annals,* **76**, No. 1, are inconsistent with the presence of negative color-indices in very distant stars. The hypothesis is now presented that the absorbing medium is confined to a local cloud or envelope of cosmic matter surrounding our cluster of stars and extending from the sun by at least 100 light years. Only stars within the cloud show increasing redness with distance; those outside would be reddened very slightly, and by a uniform amount for all distances. The principles of the earlier investigation have been applied to later and more accurate data. The results follow.

Deviations of color-index from the average of the spectral class for stars given in *Harvard Annals,* **76**, No. 6, show when grouped according to apparent photometric magnitude that faint stars of Class B are redder, faint stars of Class M are bluer.

After correction for the effect of apparent magnitude, groupings of the same stars show increasing redness with increase of distance and absolute magnitude. Greater redness for small proper motion also is indicated.

Least-squares solutions for 72 stars, having parallaxes exceeding

0″.030, show increase of redness with distance. Redness for distance increases from Class M toward Class B. Color-index is tested as a basis for classification of spectra. For the dwarf branch of the Russell diagram, the relation becomes a straight line, indicating a change of 0″.174 per magnitude. Using the deviation from the line of color-index as the measure of redness, the reduction indicates a difference in the loss of the blue and the yellow light of 0.0030 magnitudes for 10 parsecs. This appears to be the best value found from these stars.

Stars are redder in the Milky Way than at the galactic poles. There is indication that stars near the ecliptic are redder.

A general plot according to distance, absolute photometric magnitude, and redness, exhibits the relations existing between these factors.

[*To be continued.*]

FROM AN ASTRONOMER'S DIARY, 1925.

By FRANK SCHLESINGER.

In the summer of 1913, I made a journey to Europe, chiefly to do what I could to expedite the manufacture of the two discs for the thirty-inch refractor for Allegheny Observatory. On my way I stopped for a few days in London; among the pleasant features of this visit was a delightful afternoon with Sir David Gill at his flat in De Vere Gardens, whither he had retired when he laid down his duties at the Cape Observatory. This flat was then in a sense the astronomical capitol of Europe, for it is not too much to say that during the five or six years preceding Gill's death, early in 1914, few astronomical enterprises of importance were initiated in Europe without first passing through his study and getting there the benefit of his experience and discernment. It was on that afternoon that I first heard from him of the unusually promising astronomical conditions that existed on the high Veldt in South Africa. He in turn had had his attention called to this matter by Colonel (now Sir) William Morris, who had occasion through his duties as government geodesist to become well acquainted with the conditions and who carried with him a good five-inch refractor. At the time that Gill told me these facts my interest in them was only mild, but a few years later circumstances made them a good deal more exciting, when an opportunity came to erect for Yale Observatory a large telescope in the southern hemisphere. I then secured from the files of the Cape Observatory (through the courtesy of Dr. Halm who was temporarily in charge) copies of the correspondence with Colonel Morris and others. Their high opinions of the conditions have been confirmed through the experience of Dr. Alexander Roberts, the staff of the Union Observatory, and now by our own observations

at Johannesburg. This correspondence and other astronomical information concerning South Africa I afterwards loaned to Professor Hussey, who has decided to locate at Bloemfontein the visual refractor of the University of Michigan originally intended for erection at La Plata. Gill and Morris are thus responsible in large measure for the installation of at least two large telescopes upon the Veldt, and of possibly others in the future.

It was in 1920 that Yale University decided to erect in the southern hemisphere a large photographic refractor. I began at once to secure quotations for the various parts of the work, but that year and the one that followed proved to be the worst in our generation for such a project. In particular, optical glass in large blocks was difficult to procure, and the prices asked for it were out of all proportion even to the high costs that prevailed for all commodities in those years. The cost of the mounting, too, as quoted by the two firms best qualified to carry out such work, seemed to us prohibitive. We therefore decided to wait a while until conditions should become more favorable. This came about very soon so far as optical glass is concerned; early in 1922 we received from Schott and Company two beautiful discs at reasonable cost suitable for a 26-inch objective. But the situation with regard to mechanical work improved only slowly and finally forced us to consider undertaking the construction of the mounting in our own shops at Yale Observatory. After carefully studying this plan we decided to adopt it, without, I think, minimizing the risks we were running or the disadvantages involved.

It would be out of place here to go into details. Suffice it to say that the completed mounting was assembled at New Haven by November, 1924, eighteen months after we began the drawings. We did not attempt to make the driving clock or the large driving worm-wheel with its worm. The former was entrusted to George Klages Sons, of Pittsburgh, the latter to the Philadelphia Gear Works. The total cost of the mounting (including all attachments, drawings, assembling, and the machine tools that we temporarily added to our shop equipment) came to $18,000, a very great saving over the quotations that had been submitted to us.

In the meantime Mr. McDowell had completed the objective with astonishing promptness. At the end of September, 1923, less than five months after he began work upon it, he wrote that the objective was finished and that he deemed it the most perfect he had ever made. This is the last piece of work from that artist's hands, for a few weeks later we were shocked to learn of his sudden death, a very great loss to science and to a wide circle of friends.

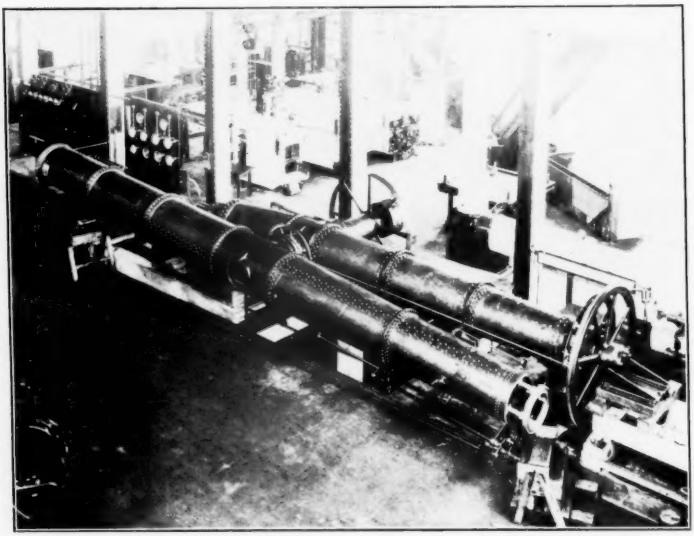
Two days after Christmas, 1924, Mrs. Schlesinger and I took ship for South Africa, carrying the objective with us as baggage and hardly letting it out of our sight until it reached Johannesburg. Soon, I think, there will be a direct passenger line from New York to Capetown, but

now it is necessary to go first to England. A very pleasant necessity this is, especially if there is an interval of ten days or so between landing at London and re-embarking at Southampton. In that time we had an opportunity to see how the titular heads of astronomy in Great Britain and Holland comport themselves when they are not astronomizing. I had the rare privilege of seeing how the Royal Astronomical Club conducts a business meeting; the character of the proceedings did not prevent the Club from exacting the usual fee, an after-dinner speech, that it invariably demands of a foreign guest. A few days later we witnessed one of those fogs that you cannot believe possible until you see one. It was thick enough to make your feet invisible unless you are extraordinarily short. It was even thick enough to make credible the story, told to us on the highest scientific authority, of the man who tried long in vain to find his home, and was finally constrained to knock at a door to ask of the woman who presented herself, "Can you tell me where so-and-so lives?", naming his own name. "Stop your silliness and come in," came the reply in a strangely familiar voice.

It was still foggy when on January 16 we left Southampton on the *Arundel Castle*, so that the first eleven hours of our southward journey were occupied in groping our way out of the inner harbor. Thereafter, however, clear skies and quiet seas favored us and made the seventeen days to Capetown along the west coast of Africa a happy adventure not soon to be forgotten. How differently from us do Englishmen, and Europeans in general, manage their leisure! The hurry of transatlantic travel is an American institution, or at least is a result of our demand for speed. The *Arundel Castle* is a fine modern ship of 21000 tons capable in an emergency of making good progress. But she could see no reason for going over fourteen or fifteen knots, and that she maintained evenly and quietly all the way. Not many hours elapse, after an English ship leaves port for a long journey, before a sports committee is organized, and contests to suit all ages and vigors are soon in full swing. I tried many varieties of these, but distinguished myself only in chalking the pig's eye, accepting a prize of ten shillings for doing so and thereby becoming a professional athlete.

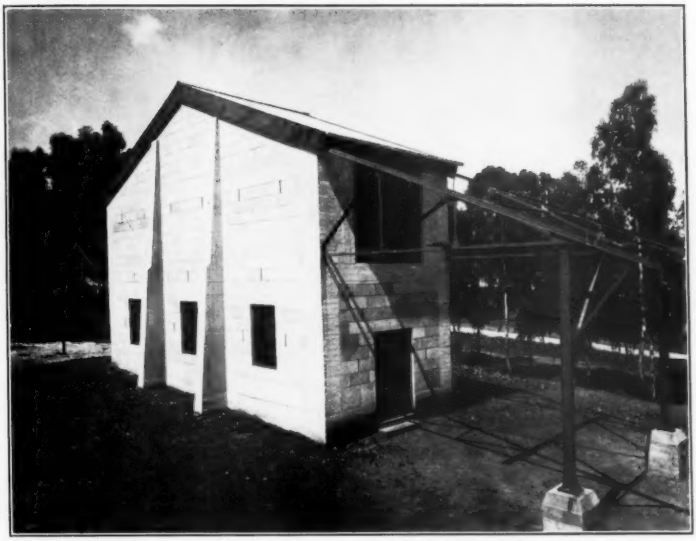
It was good to see waiting for us on the pier at Capetown our friend Spencer Jones, successor to Gill and Hough as director of the Cape Observatory. Thanks to his good offices we lost little time in getting the objective and our other effects through promptly. A reverent visit of a few hours at the Cape Observatory was the only delay that we allowed ourselves before starting on the railroad journey, nearly a thousand miles, to Johannesburg. This railroad, which is run by the government, is one of the wonders of South Africa. The best trains make this distance, almost precisely the same as that between New York and Chicago, in less than twenty-nine hours. The country is mountainous throughout and the grades are sometimes very steep.

Yale Telescope, Johannesburg, South Africa.
Observatory Building and Building for Offices and Residence.
[From the southeast.]



Yale Telescope.
[Set up in New Haven, November, 1924.]

PLATE XXVI



Yale Telescope, Johannesburg, South Africa.
[Observatory from the northeast.]

Yale Telescope, Johannesburg, South Africa.
[Office and Residence Building from the north.]

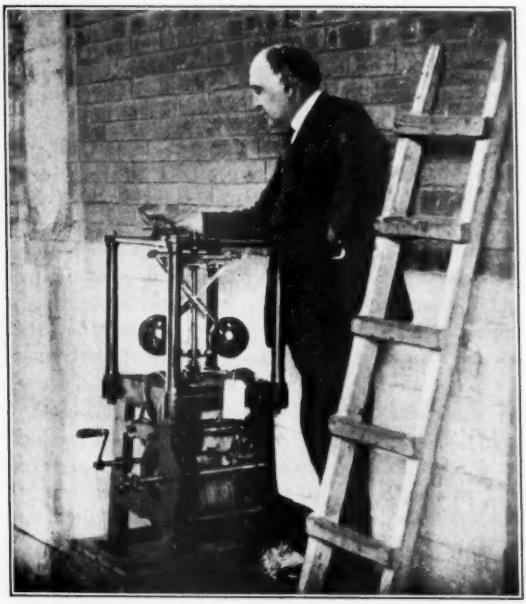
When we consider that there are only 2,000,000 whites in all the vastness of South Africa, that the fares are lower than with us and that the railroad is a paying concern, we wonder what magic is used in its administration. A partial answer to this riddle, but it can be only a partial one, lies in the cost of unskilled (negro) labor, which in most districts is as low as three shillings a day, or about nine cents an hour.

We stopped off for four days at Bloemfontein, a little more than seven hundred miles from Capetown. This city, 4500 feet above the sea, is on a very level part of the Veldt, broken only here and there by occasional *kopjes,* steep hills with level tops, one or two hundred feet high. One of these, Naval Hill, is within Bloemfontein itself. We went to the top of it and looked out upon the surrounding Veldt. It is a landscape that needs getting used to; it is as monotonous as a quiet sea, with as little life in sight and less color. For, although we saw the country in the rainy season, the sparse grass was everywhere that dull brown so prevalent in the dry season west of our Rocky Mountains. And there is no other vegetation in sight. No trees are to be seen outside the city, for none grow save those that have been planted and cared for by the whites in recent years. Within the city there is a different story to tell, for here, as elsewhere in the Union, the whites have "done themselves well"; trees, parks, and gardens make the town pleasant to behold and live in; cricket grounds, swimming pools, bowling greens, and tennis courts provide the games that seem to be so necessary to the happiness of Britons, wherever they may find themselves.

It was on Naval Hill that Professor Hussey observed for four or five months in 1924, testing the conditions with a nine-inch telescope; and it is there that he intends to erect the large visual refractor of the University of Michigan. Had we decided to put our telescope at Bloemfontein we should have preferred the site on the more accessible grounds of Grey University College (in the outskirts of the city and on the same level) to occupy which we had a generous invitation on the part of both the College and the municipal authorities.

Sunday morning, February 8, brought us to Johannesburg, 5700 feet above sea level. We were greeted at the station by Dr. Innes and Mr. Wood of the Union Observatory, both of whom I had known through much correspondence but had never met before. During our long stay in the city and in the many difficulties that our project encountered we were to find in Dr. Innes and Mr. Wood friends whose solicitude and interest in our welfare were always in evidence. Our old friend, Dr. Hertzsprung, of the Leiden Observatory, whom we have now seen almost everywhere worth while, was also at the station. He was near the end of a long and fruitful stay as a visiting observer at the Union Observatory. Among the delights that Johannesburg had in store for me were many talks with him and the staff of the Union Observatory.

We began at once to explore Johannesburg. The city covers more than eighty square miles, or nearly four times the area of Manhattan Island (to which New York City was confined until comparatively recently). Within this large area there are about 170,000 whites and as many blacks. The city is built upon many more than seven hills, and it is upon these hills that most of the residences are found. One is struck with the spaciousness and beauty of the gardens and parks. Few cities are so thickly wooded as this, yet every shrub and tree has been planted within the past thirty years. I should say that in no city of this size



Professor Schlesinger at Driving Clock of
Yale Telescope at Johannesburg.

is more tennis played, for I was told that there are nearly 10,000 tennis courts, private and public, and I can well believe it. With labor at three shillings a day it is easy to build a tennis court. As in California, the game can be played in all seasons, and much of the social life of the city is centered in these courts.

The city is well provided with paved streets, sewers, electric current, and good water. But as soon as one crosses the limits of this or any other city upon the Veldt he loses all these advantages and finds himself in open treeless country devoid, in general, of even fair roads. What few streams there are go nearly or quite dry in winter. When the population becomes more numerous and will warrant the outlay,

systematic irrigation will do wonders for the extraordinarily fertile soil. It is not that the rainfall is meagre, for in fact it is considerably greater than the average in America and Europe. But owing to the topography of the country and the dryness of the atmosphere, most of the rainfall is lost in rapid surface drainage and in evaporation.

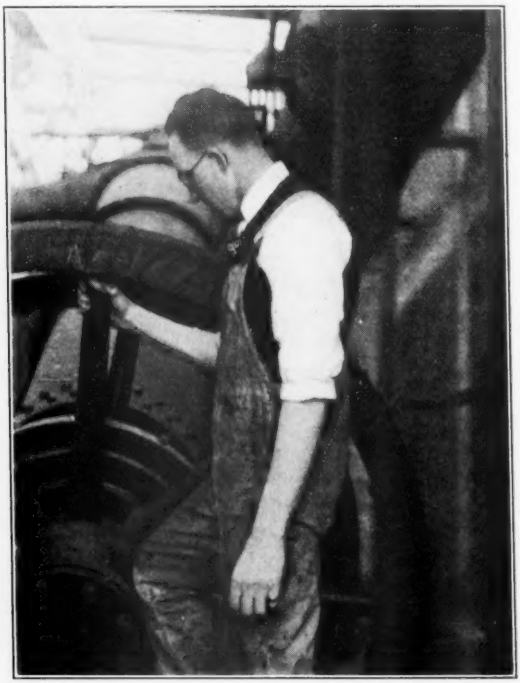
These circumstances made it necessary for us to seek a site within the city rather than in the neighboring country. Dr. Innes and other government officials had cordially invited us to locate upon the Union Observatory grounds. But after an inspection this plan did not appear to me to be the best, chiefly because the staff of the Union Observatory were already much crowded for office and similar facilities, and our coming would have seriously added to their discomfort, to say nothing of that of our own observers. On February 11, my friend Dr. Lehfeldt, Professor of Economics at the University of the Witwatersrand, took me to see the grounds of that University and introduced me to Sir William Thomson, the Principal. This location seemed to me nearly ideal for our purposes. When I expressed myself in this sense to the Principal he promptly arranged a meeting with Sir William Dalrymple, Mr. Robert Niven, and other members of what we should call the Board of Trustees, as a result of which we received a formal invitation to become the guests of the University. This we gratefully accepted, and work on the observatory building was begun at once.

In the meantime our mounting had been shipped on a freighter that goes direct from New York to Capetown, advertised to take a little less than a month for this journey of 6800 miles. Walter O'Connell, our shop foreman, accompanied this shipment in order that certain parts might be assured of the careful handling that they needed. When the steamer was only a day out of New York her machinery went wrong and she had to put back for repairs. A few days later she was ready to try again, and this time she succeeded in getting half way across before developing internal complications again. The ship's engineer managed to patch up the engines so that half-speed to Capetown was thereafter possible. Fifty days were needed for the whole trip. The mounting reached Johannesburg nearly a month later than we had expected. I have never been able to ascertain from Watler what part he played in helping to repair the ship's engines, but I suspect it was an important one, for if Walter has any characteristic more striking than his reticence it is his eagerness to get his hands upon a mechanical problem.

Our arrival in South Africa was timed partly with a view to taking advantage for our building operations of the fine fall weather beginning in March. But in this we were disappointed; 1925 proved to be one of those wonderfully exceptional years that visitors so often encounter the world over. And it really was exceptional, as the meteorological records amply showed; March and April were so wet that our building seemed to us to rise very slowly indeed, though our contractor declared

that if we were to stay on in South Africa a few years, the rate at which this construction went up would seem bewilderingly rapid. We did not enjoy this rainy fall as much as we might, but we did get some amusement out of the profuse apologies with which our Johannesburg friends greeted us every morning and the frequent predictions that this surely must be the last rain of the season.

The completely assembled telescope was set upon its two piers by May 20. A few days later Dr. and Mrs. Alden and their two little



Dr. Harold Alden, in charge of Observatory at Johannesburg.

daughters arrived to take up their long residence, so far from their home and in such novel surroundings. I remained at Johannesburg nearly a month more, in which time we tested all the essential functionings of the optical and mechanical parts of the telescope.

The observatory building, as the illustrations show, is of novel design. I have described briefly elsewhere,* and intend to describe in detail later, the advantages and disadvantages of this type of building.

**Publications of the Astronomical Society of the Pacific*, Vol. 38, p. 142.

Within a few yards of the observatory the University of the Witwatersrand has generously erected a handsome and substantial building containing living quarters for the astronomer in charge and for one assistant, two large office rooms and a dark-room. This building was finished in October.

June 22 was the day of the visit of the Prince of Wales to Johannesburg, and incidentally this was his thirty-first birthday. At the suggestion of the University authorities, and of course with our hearty

Prince of Wales and Professor Schlesinger.

concurrence, it was arranged that he should officially open our observatory. This he did with so much charm and tact that one life-long republican was all but converted to a belief in the superiority of monarchical institutions.

When we took our departure from Johannesburg on June 24 it was by the boat train to Capetown, and the next day we were once more at sea, returning to Southampton on board our old friend the *Arundel Castle*. We had expected to see a little of the country before leaving, but the date of our sailing was fixed long in advance, and the delays in the arrival of our mounting and the completion of the building barely

left me time to do what I had planned at the telescope. Johannesburg and its surroundings we got to know intimately, and we had had a few hours at Capetown and a few days at Bloemfontein; but we claim to have seen less of South Africa as a whole than any other visitors who have been within its borders for an equal length of time. All of our knowledge of Rhodesia, the wonderful Victoria Falls, the beautiful coast of Durban, the diamond mines at Kimberley, is still founded only on the booklets issued by the railroad and steamship companies.

The journey southward had turned our world upside down. It is disconcerting to see Orion's sword higher than his belt, or to see the Scorpion flying in the zenith when he should be crawling along the horizon. On the journey north it was correspondingly comforting to have these old friends come to their accustomed places. Their return made up in a measure for the parting from so many new friends that we had found in South Africa, the prospect of rejoining whom seems so remote.

Yale University Observatory, September, 1926.

SHADOW BANDS.

By W. J. HUMPHREYS.

Dr. S. A. Mitchell, as Chairman of the Eclipse Committee of the American Astronomical Society, requested me to examine the reports of shadow band observations made at the time of the total eclipse of the sun on January 24, 1925. Through the kindness of Professor E. W. Brown, especially, and of several others, all of whom I hereby earnestly thank for their generous aid, I have had the privilege of reading many records of the excellent displays of shadow bands seen on that occasion. These displays were rendered unusually conspicuous, and correspondingly valuable for observation, by the general snow covering; and further intensified, perhaps, by the fact that the time of occurrence was mid-forenoon, when convection was active but presumably still confined within, probably well within, the lower 1000 feet of the atmosphere.

The reports differ considerably in detail, but in respect to the essentials they are much alike, and practically the same as those of the shadow bands seen at the times of various other eclipses.

A composite of these reports may be summed up as follows:

When bands were seen: From totality to 2 or more minutes before and after, even 20 minutes being reported. Perhaps the extreme cases were owing to heated air from chimneys; one or more were proven at the time to be so caused.

Length of bands: Broken, confused arcs, short splotches to 3 feet in length; generally 1 to 2 feet.

Width of dark band: ¼ inch to 4 inches, increasing with time before or after totality.

Width of bright band: 1¼ inches to 3 feet, also increasing with time from totality.

Velocity of travel: Stationary (shimmering) to very fast, estimated as possibly 30 to 40 miles per hour, at right angles to length of bands.

Character: Narrowest, most distinct and most sharply defined immediately before and after totality, becoming broader, farther apart and more indistinct, unto disappearance, with increase in width of visible solar crescent.

The bands were substantially the same after as before totality, and very much like the shadow bands cast upon a vertical screen by a distant, powerful arc light.[1] Their description, therefore, appears to be practically complete in every detail. Their explanation, however, is not so satisfactory.

Evidently, as Hastings[2] pointed out long ago, the only conspicuous motion of the bands must be at right angles to their length. A shadow moving along itself, being everywhere alike, would not seem to be moving at all. Also, as he further explained, if these obscurations are owing to irregularities in the density of the atmosphere, they must lie mainly parallel to the crescent of the sun. This is because the ends of the crescent, more than its sides in proportion to their greater distance apart, would shine around every such disturbance, except those that lie parallel or nearly so to the crescent itself, and thereby restrict to the latter the deepest shadows.

From these two generalizations, (1) that the shadow bands must parallel the solar crescent, and (2) move, apparently, at least, normally to their length, it follows that there can be no relation between the direction of their travel and the course of the wind at any level.

In the main these inferences fit the observations, from which it seems highly probable that the shadow bands really are due in some way to irregularities in the optical density of the atmosphere. There are several such ways that might seem possible. Four of the more obvious are considered in what follows; in which it is assumed, correctly in the main, it is believed, that the irregularities in density are due to differences in temperature.

1. Since the upper limit, or current ceiling, of active convection, when largely owing to wind turbulence, is marked by an abrupt temperature inversion, we may regard such ceiling, when thus produced, as a corrugated interface between warmer air above and colder below. In the absence of clouds this corrugation in turn, like ripples on water, produces condensations and dispersions of light from a celestial object on the surface of the earth beneath.

Let the highest temperature of the air just above the interface be

[1] Preston R. Bassett. POPULAR ASTRONOMY, vol. 33, p. 232, 1925.
[2] C. S. Hastings. *Light.* Charles Scribner's Sons, 1902.

3°C., and the lowest temperature of that just below it, 0°C., a temperature contrast of common occurrence under the assumed conditions. Then, if this ceiling is not far above sea level, the refractive indices of the air above and below it will be, approximately, 1.000290 and 1.000293, respectively, and the deviation by refraction of a ray of light transmitted at even 60° incidence only about 1″.1. Clearly an interface of the corrugated, or cylindrical lens, shape producing so little refraction would have to be 3 or 4 miles distant to give the contrast between light and shade seen in many shadow bands, and a mile or so above the surface even when, as in the case of the eclipse under discussion, the sun is only 20° above the horizon. Now, this type of interface generally is much less than a mile above the surface and certainly was, in fact probably did not exist at all, over the eclipse path in New England the morning of January 24, 1925, as the winds there were very light at that time. There may have been and, as the air was still and cold, probably was an inversion due to thermal convection, but much less abrupt and effective than that here assumed.

For this reason, therefore, and also because such lens-like refraction would as often give narrow bright bands as narrow dark ones, whereas according to observations no such equality exists, it seems that shadow bands must be produced in some other manner.

2. Let the convection be of thermal origin, and consist of side-by-side rising and falling columns, or masses, of air, and let the incident light above be of flat wave front. On reaching a lower level this wave front will be warped, having travelled faster through the rising lighter columns than in the descending denser ones, and the warping will produce on the ground beyond more or less increase of light at certain places and depletion at others.

Qualitatively this looks promising as an explanation of eclipse shadow bands, but it seems that on the average the light and dark bands should be of equal width and not as observations show them to be—radically different. Furthermore, owing to the fact that the distance between shadow bands often is only a foot or so, and even less, and the further fact that these bands show when the zenith distance of the sun is even around 70°, as in the case of the eclipse under discussion, it would seem that a path one meter long through the rarer versus denser air would be much greater than that which occurs on the average under such circumstances. Assume, then, that this distance is one meter, and that the refractive indices of the two columns average 1.000290 and 1.000291, corresponding, approximately, to the temperatures 1°C. and 0°C. respectively. This gives the faster portion of the wave front a lead of about 0.001 mm over the slower. Hence the "focus" at which shadow bands a foot apart would be best produced would be around six kilometers distant. Apparently, therefore, this method also of accounting for the shadow bands is unsatisfactory.

3. Let the light pass from the rising lighter air into the denser de-

scending masses nearly tangentially to the interfaces between them, thereby undergoing the maximum or border refraction of the type that permits the photography of sound waves. The magnitude of this refraction clearly depends on the length of the path of the light through the transition shell, the thickness of the shell, and the difference between the outer and inner densities. If the ratio of this path length to thickness of shell is the same as that of the path of a ray of light through the atmosphere from a star on the horizon to the depth of the air, and the outer and inner temperatures differ by 1°C. then the refraction will be around 8″. This follows from the facts that (1) the refraction of a ray reaching us horizontally from a star is, roughly, 36′, and the change of the refractive index μ of the air per 1°C. roughly $(\mu - 1)/273$.

The ratio of length of path to thickness of shell, or the density difference, or both, frequently may be greater than here assumed. At any rate from the amplitude of the scintillation waves on the border of the sun it seems that this refraction, though necessarily varying greatly, might often be 10″ or more.

This border refraction evidently would produce more or less distinct shadows in the case of a point source of light, but not so where the angle subtended by the source is several fold the deviation. Hence shadow bands of this origin presumably could not be seen more than thirty seconds before and after totality. But they are seen over much longer intervals, from which it follows that they are not mainly, if, indeed, to any extent, caused in this way.

4. Instead of the light passing, as just assumed, from the lighter to the denser air, let it go from the denser towards the lighter. This will be its course in countless cases since, in thermal convection, the lighter air commonly rises in numerous isolated masses, as we know from direct observation and from the fact that wherever it does go up with appreciable velocity in a *connected* column of considerable height a whirlwind necessarily is established—and whirlwinds are only occasional phenomena.

In this case too, as in the last one above, the refraction of the shell, or transition layer, may be of the order of 10″. Here, however, the bending of the light is such as to simulate total reflection over a small area of the interface. In reality there is a deflectional bending of the rays as they pass through the shell exactly as in the case of the inferior mirage, so common over summer heated streets and smooth roads. In this manner all the light from any object included within the "angle of total reflection," covering an arc of 10″, say, is wholly excluded from that place on the surface of the earth which it otherwise would have reached, and added to that alongside this place.

In this way the crescent of the sun, from totality to a few minutes before and after, must produce narrow shadow bands, more distinct and more numerous, since smaller inhomogeneities would then suffice,

as totality is approached, each bordered on one side by an extra bright narrow strip. Furthermore, the width of a bright-dark band thus produced generally would be much less than that of the intermediately lighted strip between successive bands. Finally, there would be no uniformity in either the widths of the bands or the distances between them.

Apparently, then, shadow bands are owing to pseudo-total reflections, or mirage effects, produced by the transition shells between warmer and cooler adjacent masses of air in a state of thermal convection.

The bright borders inferred above do not appear to have been reported. A careful search for them should be made during the two or three seconds before and after totality when evidently they would be most distinct.

THE PRACTICAL USE OF SMALL REFLECTORS.

By WILLIAM H. PICKERING.

Introduction.

When it was finally decided that the 11-inch Clark refractor was to be taken down and returned to Harvard, in 1925, it at once became a question as to how we could replace it to the best advantage. Certain personal facts obviously had to be considered. Only two more apparitions of Mars, those of 1926 and 1928, were needed to complete my observations throughout the planet's year, which beginning with the apparition of 1914, had been well observed from ☉ 0° through 300°. Furthermore on account of advancing years it did not seem desirable to purchase an expensive instrument, when failing eyesight would finally render it useless. What was believed to be a sufficiently large refractor was soon found from these points of view to be out of the question. I had never had any faith in large reflectors for planetary work, and this opinion was fully confirmed by the results obtained on Mars in 1924 (Report No. **35**). It seemed, however, as if something might be done with a small reflector in our equable tropical island climate, and this view was corroborated by the excellent drawings of Mars made, under what were believed to be less favorable atmospheric conditions, by our associate Mr. Wilson, with his 11-inch instrument at Nashville, Tennessee (Report No. **34**). Our Asiatic observers had also succeeded in seeing much fine detail with small reflectors, which we were able to fully confirm with our refractor.

I had never used a reflector and only once or twice looked through one, and I felt very much the need of some definite information based on a comparison of a really first-class reflector with a first-class refractor, in a first-class climate,—especially with regard to the planetary detail which they would show. At present no such information, out-

side perhaps of what may be drawn from my Reports on Mars, is anywhere attainable. I am therefore giving my experience after a year's investigation, starting from the very beginning, in the hope that it may be of some use to others.

I decided to begin by purchasing only a small instrument, on an inexpensive mounting, and, if my results seemed promising, to purchase a larger one later. I accordingly wrote to a maker of small reflectors, inquiring with regard to a 10-inch telescope, telling him my plans, and asking him if he thought he could build me a larger one in case I wanted it. As he assured me that he could do so, as he had already successfully made me a small flat, and as his answers to my other questions appeared satisfactory, I ordered a 10-inch reflector from him in January, 1925, before the 11-inch refractor had yet been taken down.

He wrote that the instrument would be ready for shipment in about a month, and I then told him that as I intended to continue my observations of Jupiter's third satellite in the following summer, and must before then get fully used to my telescope, it was necessary that I should have it just as soon as possible. It may be mentioned here that as our seeing is best in the late summer and early autumn, as is the case with most northern observatories, for these difficult observations of the satellite the three apparitions of 1925, 1926, and 1927 were much better than any others. Also that during the apparition of 1926, although the conditions were entirely favorable, yet the observations would be materially interfered with by the work on Mars. The apparitions of 1925 and 1927 were therefore the most favorable ones during this revolution of Jupiter.

After a little more correspondence it appeared that satisfactory progress was being made, but delays occurred, and it was only early in April that I was informed that all the optical work was finished, and that the telescope would be ready to ship in a couple of weeks. Then reports suddenly ceased, and as the weeks dragged on, information could only be secured by cable. Finally, on a threat to cancel the order, I was informed that the instrument would be shipped to me on June 29, three months after it had been promised for shipment in two weeks. No explanation could be obtained as to the cause of this delay, but as it would take not over a month to build a 10-inch reflector, and test it, with the simple mounting that I specified, and as customers are rather frequent during the spring months, it did not take very deep thought to fathom the probable reason. The telescope reached the observatory August 22, and the first observation was secured with it September 5, after a suitable pier and shelter had been constructed. This was just eight weeks after the opposition, and therefore too late to carry out any of my anticipated observations of Jupiter's satellites. We have therefore to depend now on the apparitions of 1926 and 1927.

Tests of the telescope presently showed that, although it was obvi-

ously far inferior to a good refractor of the same aperture, yet it was good enough, in the Jamaica climate, to make it worth while to order the larger instrument already planned,—of a more reliable dealer. Several makers of small reflectors, besides the two well-known manufacturers of large ones, are located in our eastern and central states, and a number of amateurs of a mechanical turn of mind, are now making mirrors for themselves. England, however, is the natural home of the reflector. The first two ever constructed, of rather less than one and a half inches aperture, were made by Sir Isaac Newton with his own hands, and the second and better one is now in the possession of the Royal Society. Englishmen have been making small reflectors for the past two hundred years, and it is not likely that better ones, with better mountings, can be secured anywhere else. Moreover, many are in the hands of amateurs, and as these die, their instruments are sent by their families for sale to the dealers. Since the demand in England for what may be described as luxuries has rather fallen off since the war, some exceptionally good bargains may occasionally be picked up there (see that popular magazine, *English Mechanics*).

Since the field of distinct vision of the reflector is much smaller than that of the refractor, it is very desirable, particularly for planetary research, where high magnification is employed, to have an equatorial mounting driven by a good clock. Since the latter cannot readily be made by an amateur, the advantage of purchasing one's instrument rather than making it oneself, to those who can afford it, is obvious. The driving clock on which I had been brought up was the Bond spring governor with electric control, as made by the Clarks. This is regulated by a swinging pendulum, and when it can be kept in perfect condition will run for hours without losing a beat. It is therefore particularly desirable for long photographic exposures, where even with long focused lenses one need only correct the position occasionally for refraction, by means of the finder. To keep it in perfect running order is, however, exceedingly troublesome, and for visual observations or for short exposures, the revolving pendulum or governor is distinctly preferable, and is in general use for these purposes. For photography, however, the object needs constant watching through a finder with high magnifying power.

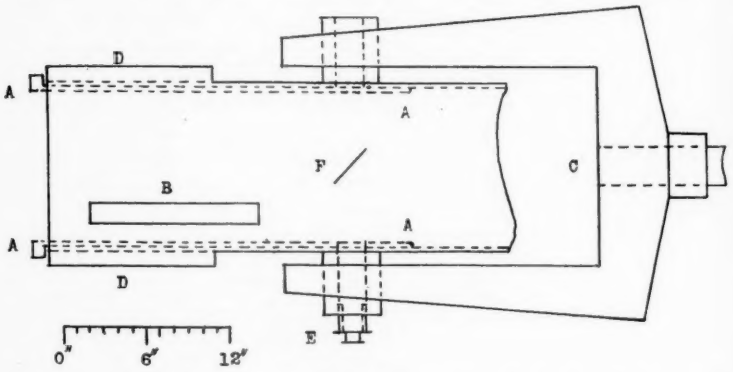
Practically all small reflectors are made of the Newtonian, as distinguished from the Cassegrain form. In these we look in at the side of the top of the tube instead of through the bottom, as in a refractor or Cassegrain. If the focus of the telescope exceeds six feet this naturally is inconvenient. Moreover, since the finders, of which for comfort there should be two of the same power, are refractors, we have to arrange our seat or ladder so as to look first through the most conveniently located finder, directly at the object, and then in a direction at right angles to it into the telescope. For further ease and adaptability the eyepiece, flat, and finders are always attached to a

sleeve rotating about the axis of the telescope. This sleeve should also carry the mirror, as it does with the higher class instruments, otherwise the finders will furnish only a rough and changeable indication of the direction in which the telescope is really pointed. With a refractor or Cassegrain on the other hand, if used in tropical regions, where the planets sometimes pass north of the zenith, and you cannot, as you can for a star, wait until it reaches a lower altitude, a diagonal eyepiece is always necessary, which turns the drawings right for left. This, however, has the incidental advantage, that when looking horizontally into a telescope, there is always rather less trouble from the moving thread-like objects in the eye, than when we look through it at an inclination, either upwards or downwards.

For a Newtonian reflector the fork mounting is preferable to the usual German form. In the first place because it permits the intersection of the declination and polar axes to be materially nearer the ground, and every inch saved there is of distinct advantage when seated on top of a light frail step ladder, or even when standing on it lower down, if the focus of your telescope is in the vicinity of ten feet. A still greater advantage over the German mounting is that it is never necessary to reverse the telescope in the midst of an observation when the star or planet passes the meridian, thus saving also valuable time. If it is proposed ever to observe near the pole, this would of course involve a long and rather heavy fork. The curious Springfield mounting, described and illustrated in the *Scientific American*, 1926, March, 166, is named for the Vermont town where it was invented and first constructed, and has the distinct advantage for a Newtonian reflector that the observer does not change his location, but simply sits in a comfortable position, and looks down the polar axis of his instrument. Owing to the third reflection, his drawings will be turned right for left. The loss of light is of little consequence. The cannon ball apparently serves as a combined counterpoise in both right ascension and declination. This form of mounting should, I think, be very satisfactory for the amateur, but for the professional I believe these two counterpoises should not be combined. Neither do I like the substitution of a stud and plate for a long polar axle, which would obviously give a more uniform motion in right ascension if the telescope were driven by a clock. With these modifications the mounting appears to me attractive.

The very great inconvenience of the movable high seat, and the nuisance of the revolving tube, in the larger sizes of Newtonian telescopes as ordinarily constructed, should certainly be avoided if possible. Were I building a telescope, which I am not, I should be inclined to try a still different arrangement. I should at once sacrifice that portion of the heavens in the immediate vicinity of the pole, possibly all that portion north of declination $+60°$. This is about one-fifteenth of the whole heavens. This would cut me off from observing

two out of the five well known stars in Cassiopeia. The northern pointer in Ursa Major would also be eliminated. The constellations of Camelopardalis, Ursa Minor, a portion of Draco, and Cepheus would also be beyond my reach. But none of these are of any consequence, and I should leave them to other observers. I should then construct my mounting as indicated schematically in the accompanying figure.



The length of the telescope could be anything desired,—as long as a refractor if convenient. I have drawn the tube 12 inches in diameter. The breadth of the casting of the fork at the end of the polar axle *C* is assumed to be 6 inches. It might perhaps be narrower. The distance from this point to the center of the flat *F* is 18 inches. The mirror is not shown, as it would be beyond the figure to the right. The light from it strikes the flat, and is reflected through the short declination axle to the eyepiece *E*. Either end of this axle can be used, and in order to do this the flat is supported by a tube *A, A, A, A,* which rotates within the telescope tube. A hole in these two tubes transmits the light from *F*. There is no need in this case of rotating the large mirror. One of the finders is shown at *B*. There should be another similar one on the other side. The counterpoise ring is shown at *D, D*.

The observer's height will not change greatly during the observation. Otherwise he will not move until the object crosses the meridian, when he will shift to the other side of the pier, carrying the eyepiece with him, or using a duplicate one. For northern objects whose altitude does not exceed 30° he will have to look upwards at an angle of 60° or a little more, but this is not unusual to those accustomed to the use of a refractor. When the object crosses the meridian he will be looking horizontally. For a very long focused reflector it is possible that a movable seat could be attached to the pier. With such a short fork the observer would find that objects crossing the meridian at an appreciable distance north of his zenith would be cut off for a short time by the pier itself. This could be partially remedied by making the tines

of the fork longer, or by using an iron pier cut away at the north, of the form shown in the two photographs (Plate XXVII). An incidental advantage of the fork mounting is that we can readily make the tube appreciably larger than the mirror. This it is believed would avoid some of the trouble caused by air currents circulating within the tube. With the German form of mounting such an increase of size would add considerably to the expense. It is believed that the fork mounting could be manufactured more cheaply than the usual form.

In order to do original work of real value on the moon and planets we need a magnification of about 400, and for double stars twice as much. The usefulness of double-star measures is by no means eliminated by the work of the larger telescopes. With a telescope of 8 feet focus these magnifications mean a one-fourth inch eyepiece for planetary work, and one of one-eighth inch focus for double stars. The former is unsatisfactory, and the latter impracticable. In a micrometer the spider webs would be too large, and the movable and fixed threads could not be focused at the same time. The obvious method of avoiding this difficulty is to use a Barlow lens, which may consist of a double concave of short focus and small aperture, such as used in an opera glass. This is placed near the focus, and between it and the mirror. By varying its distance from the eyepiece we may obtain almost any magnification that is of real use, even with an eyepiece of one-inch focus. The Barlow which I use is of the approved form, and is an achromatic concave meniscus with a focus of —4.5 inches, and a diameter of 1.3. It consists of a cemented lens with a slightly convex crown turned towards the mirror, and a rather more markedly concave flint. It is placed six inches from the eyepiece, and increases the equivalent focus of my mirror about three times. The increase in length of the eye tube is four inches. By the use of this device the small reflector becomes a better instrument for planetary research, and even double star work becomes practicable. The latter use does not, of course, require as good seeing as the former. For double-star measurements with small refractors of 12 inches aperture or less, a Barlow lens may also be used to advantage. Its chief disadvantage is that the field of distinct vision is exceedingly small, only a few minutes in diameter. Outside of this field, even with a reflector, we get colored images.

Adjuncts to the Reflector.

Leaving at once to one side the well-known objection to the reflector, that its two mirrors have every few years or oftener to be resilvered, depending on the purposes for which it is to be used, we will discuss now the mechanical difficulties that are inseparably associated with those which are of moderate size. To every northern observer, excepting comet seekers, the portion of the sky which he will most frequently study, lies near the meridian, and to the south of the zenith. Now the position of the mounting itself makes this portion of the sky

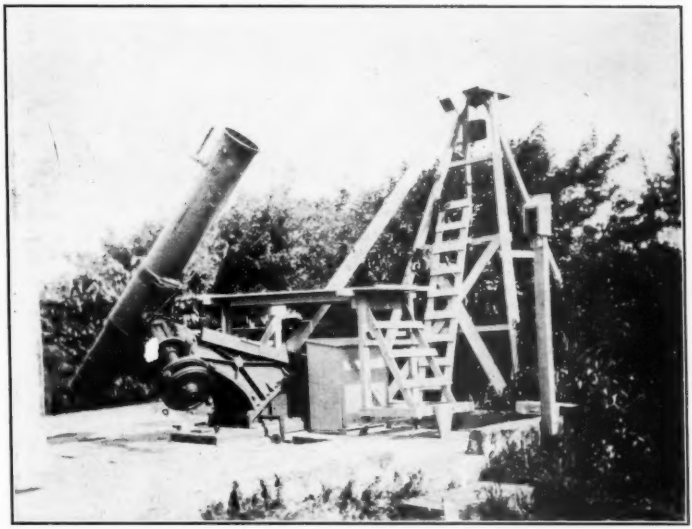
the very most inconvenient of all to observe with a Newtonian reflector. By pointing the eyepiece either east or west, we can observe it from a step ladder, but with a telescope of eight or ten feet focus it becomes very inconvenient to place the ladder in a position suitable for the purpose. I have not seen this question discussed in any work on the telescope.

It soon became evident to me, however, that the best solution was to build a light bridge across the mounting, which could be moved on rails or on castors, either north or south as proved necessary. For an object near the horizon we find it often convenient for one end of the bridge to be further north than the other. The flooring of the bridge therefore is not fastened to the piers, but consists of three loose boards, measuring eight feet long by one foot wide. These are cleated lengthwise underneath for strength, and to prevent slipping off the piers. The observer either sits directly on the bridge, or on a box placed on it. I use two boxes, one 5 inches thick, and the other measuring 10x5x20. These dimensions I have found suitable for a telescope of 9.5 feet focus. When observing north of the zenith I simply stand on a 5.5-foot step ladder which rolls on castors, resting my observing book on the upper step. We thus use our eyepieces in two positions only, one facing north and the other south. It is convenient occasionally, however, to shift the eyepiece a few degrees east or west of the meridian.

In our climate the nights are practically always calm. We therefore use a shelter rolling on a track leading off to the north. Since our pole is so low, 18°, the shelter cuts off that portion of the sky north of declination +75°, but if we ever had occasion to observe it, the shelter could be removed and returned without much trouble. A rolling shelter gives better seeing, more room, and is cheaper to construct than any other. Before setting up a reflector the dealer should inform us of the distance from the intersection of the declination and polar axes to the most remote portion of the mirror end of the tube. With a German mounting this will naturally be on its outer side. Not having this information I placed the intersection of my axes too low, and had to dig pits nine inches deep in order to reach the meridian, in places near the zenith. These pits I filled with movable wooden crickets. At first I regretted this, but later was rather glad of it, since I found my bridge had even then to be four feet and three inches high, which is plenty high enough, especially if you happen to fall off of it in the dark, as happened to one prominent American astronomer.

In order to avoid this possibility I use a twenty-watt light run by my Delco, supported on a tower, which at a distance of twenty feet illumines the bridge and mounting, when wanted, with the light of two full moons. The height of the bridge should for convenience be four feet below the level of the flat, when the latter is directly over the intersection of the axes. Beneath the bridge I keep a box holding a switch board and my Edison battery, which furnishes small two to four candle power lights for recording, illumination, etc.

PLATE XXVII



Views of Professor William H. Pickering's Reflecting Telescope and Mounting at Mandeville, Jamaica, B. W. I.

In a general comparison we may say that for the same aperture, the reflector, on account of its shorter focus, requires a smaller shelter than the refractor, and is much lighter to handle. On the other hand there are many more small things to do, so that it takes twice as long to open and point on a star with the clock running, and twice as long to put it away. This is a distinct disadvantage if the clouds suddenly and unexpectedly clear off, or if a sudden shower of rain comes up. Also it takes several times as long to shift from one object to another. For certain classes of work, or if one wishes to show the heavens to visitors, this is a further disadvantage. With a reflector of shorter focus these difficulties would materially diminish. On the other hand the star images would be larger angularly, and the definition poorer. Without a dome and revolving bridge, ten feet is probably the limiting convenient length of focus for the ordinary form of Newtonian reflector.

In our climate the temperature changes in the mirror, as determined by examining the image of a bright star inside the focus, are very slight after the first hour after sunset. But the troubles generally attributed to air currents within the tube are sometimes considerable, especially towards morning. My studies with the 10-inch reflector led me to believe that a small increase of aperture of a few inches would be desirable, but that the nights on which a much larger aperture of, let us say, sixteen to twenty inches could be used to distinct advantage, would be very few. On inquiry abroad I found that I could obtain a 12.5-inch Calver telescope complete, at what appeared to me a reasonable price. Among the makers of small reflectors the name of Calver carries in England about the same meaning that the name of Clark does for refractors in America. There may be others equal, but none better. Calver's best known large mirror is the 37-inch Crossley reflector, formerly owned by the late Mr. Common, and now used most successfully at the Lick Observatory.

He makes two distinct forms of mounting, the kind that I have, illustrated in Plate XXVII, and the usual form. The latter is rather cheaper and, for southern observers at least, has certain advantages. Thus when west of the pier my telescope can only reach south declination —25° without bending the rod giving the slow motion in right ascension, but when east of the pier it can be pointed as far south as —47°. The telescope was of course built to be used in England, where these southern declinations are not required. By removing the rod the south pole can be reached. Between declinations +80° and +40° the revolving crank shown in the lower figure will strike the tube when the latter is west of the pier and approaching the meridian. The amount of sky cut off ranges from $1^h\,45^m$ to $2^h\,23^m$, the latter being at declination +60°. This, however, clearly in no way interferes with our planetary research. On the other hand the stout and unusually long polar axle in the form of mounting which I have gives exceptional steadiness and stability to the telescope.

The revolving right ascension circle furnished by Mr. Calver and graduated on both edges, with two verniers, one attached to the mounting, and the other to the polar axle is convenient. The former gives the sidereal time, the latter the right ascension. We first start the clock and set the revolving circle by means of the fixed vernier to the sidereal time. As long as the clock is running the circle will revolve with it, and will continue to give the time. It is quite independent of the telescope, which may now be set by means of the other vernier on any object directly by its right ascension. For those who do not possess a sidereal clock the sidereal time may always be found simply by setting the telescope on any bright star whose position is given in the *Almanac*, and turning the circle to the proper right ascension. If the clock had an independent winding device by which it could be kept running continuously throughout the evening, that would be an improvement.

The two figures in Plate XXVII scarcely need any further explanation. The upper one is taken from a point a little north of east, the lower from the northwest. This description with the figures is sufficient to give any astronomer a fair idea of our latitude, and to show that we are north of the equator. Some of the foliage would indicate to a botanist that we are tropical. The roof on the top of the tower begins to interfere with our view of the sky for objects in declination —38°. The inclined inverted trough leading from the top of the tower to the southern end of the mounting covers the wire rope which drives the clock, and which runs for two hours. The small box near the top of the trough covers and protects the electric light. Were I to build the bridge over again, I should have a narrow platform at the top of each pier so that the ladders should never get under the main platform. This sometimes happens when the piers get too near together. Otherwise I see nothing in any of the construction to alter. In a later paper I hope to discuss the relative defining powers of the 11-inch refractor, and the 10 and 12.5-inch reflectors. In the meantime I may say that the Calver telescope is giving satisfactory results, and all that I expected of it.

Private Observatory, Mandeville, Jamaica, B. W. I.
August 24, 1926.

THE METEOR.

By RUFUS O. SUTER, Jr.

One hundred trillion miles out in space an immense fragment of iron is rushing toward the Solar System at the inconceivable rate of twenty-six miles a second. It weighs thousands of tons and has been traveling for countless centuries. A million years before, it belonged to a great group of meteors which traveled in the wake of a majestic comet; but

the comet and its companions have long since been annihilated, and all that remains of the magnificent company is this solitary traveler.

He clings to the ancient path of his companions, which, because it is an immense ellipse, brings him every few hundred thousand years into close proximity with the Solar System. He is accustomed to paying his respects to the sun, then dashing off into the vast abysses of space.

Days grow into years, years into centuries. The distance separating him and the Solar System grows less. He passes the orbit of Neptune, the frontier of the Solar System, and making a great swerve is about to swing around the sun and hurl himself away. Suddenly an immense dark object looms before him. It is the earth. Unfortunate meteor! Unfortunate earth! A few seconds longer and they must crash—the meteor rushing toward the planet at twenty-six miles a second; the planet rushing toward the meteor eighteen miles a second. Unsuspecting inhabitants of earth, little do you dream what casualties are in store for you! No earthquake, no volcanic eruption can equal so horrible a catastrophe! Is it not possible that the whole of one of your great cities may be wiped out—the people, the buildings, the results of all your labors? None of you can escape. In one second your happiness and prosperity of centuries will be reduced to death and destruction. Two hundred miles separate the great mass of metal and the flourishing world. One hundred miles separate them. The meteor is entering the filmy atmosphere. How harmless seems the air! Little does he realize that this gauzy, invisible substance is ten thousand times more powerful than he. Already it has begun to reduce his speed. He struggles to free himself from the fatal heat which gradually is removing the chill of his surface. The chill vanishes. He grows warm, hot, redhot, whitehot, he bulges, he begins to melt, he bursts into a flame of fire! Thus the career of this adventurous meteor ends in a tragedy. From a horrible engine of destruction, he is reduced to dust.

* * * *

Sixty miles below, in the calmness of a clear, midsummer's evening, two little children are watching the sky. A bright light flares up; shoots half way across the heavens; breaks into tiny balls of fire, and vanishes. "What a beautiful shooting star!" they cry.

Were we not protected by the atmosphere, a shield which nature has provided for us, the toll of casualties caused by meteorites would be increased a million-fold. Now and then shooting stars do actually strike earth's surface.

Fifty years ago, a German near Schaffhauser, while crossing his field, was shot through the arm. Aid was summoned, but neither the would-be-assassin nor the bullet could be found. A tiny fragment of meteoric matter, which to all assurances had recently fallen, lay on the ground near by.

Different accounts are on record where ships have narrowly escaped being struck by mammoth meteorites. Doubtless there are cases where

the ships did not escape. This, probably, has been the fate of many vessels which have sailed out to sea and never returned. Land occupies so little of earth's surface that the majority of meteorites must fall into the ocean.

Meteorites are composed of the same elements which constitute earth: stone, iron, nickel, copper and many others. Until recently no organic matter had been discovered in them. Indeed all inanimate matter was considered inanimate; but the French Academy of Sciences announced a few months ago that "meteors are not meteors but living animals." Meteoric matter and rocks are reservoirs of living organisms which for countless centuries have existed in a state of suspended animation. Souffland and Galippe have actually revived these organisms. Such a discovery seems too sensational to be true. It is proof that life exists elsewhere in the universe than on earth, and also may throw light on the secret of the "possibility of eternal life."

Meteoric phenomena are so diversified that a large number of causes may be considered operating. Some meteors are fragments of comets and planets which met disaster. Others were hurled from prehistoric terrestrial volcanoes. A few found their origin in the tremendous lunar cataclysms. The majority of them are condensed particles of ancient nebulae, which fall peacefully through space until they are seized by some comet, or collide with a planet or sun. Meteors are the debris of the Universe.

PLANET NOTES FOR DECEMBER.

By CLIFFORD E. SMITH.

The *Sun*, during the month, will cross Ophiuchus and part of Sagittarius. On December 22, soon after entering Sagittarius, the sun will be at the winter solstice (R.A. $18^h\ 0^m\ 0^s$) and thus for the remainder of the month will move slowly northeast. For December 1 the position of the sun is R.A. $16^h\ 25^m\ 4^s.74$, Dec. $-21°\ 39'\ 22''.7$, for December 31, it is R.A. $18^h\ 37^m\ 14^s.24$, Dec. $-23°\ 10'\ 20''.2$.

The phases of the *Moon* will occur as follows:

New Moon	Dec.	4	at 12 P. M.	C.S.T.
First Quarter		12	" 1 A. M.	"
Full Moon		18	" 12 P. M.	"
Last Quarter		26	" 11 P. M.	"

The moon will be at perigee (nearest the earth) on December 12 and at apogee (farthest from the earth) on December 26.

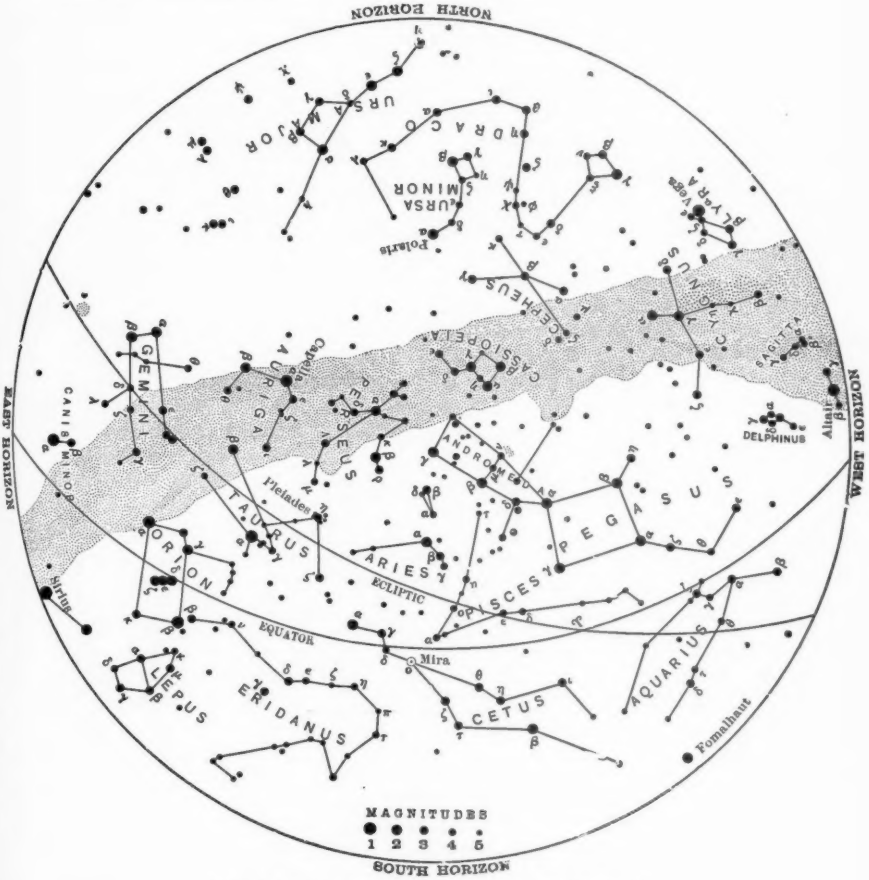
Mercury is in Ophiuchus just west of the sun. On December 14, Mercury will be at its greatest elongation west, and will then rise about one and a half hours before the sun.

Venus is close to the sun on the east and will not be visible during this month. At the beginning of the new year Venus will set about one-half hour after the sun.

Mars during December will be in the most favorable position for observation

of all the planets. It is in Aries about 10° west and north of α Ceti. At the end of the month telescopic observation can be started soon after sunset.

Jupiter is moving northeast in Capricornus and it will be just entering Aquarius at the beginning of the new year. During December Jupiter will be a conspicuous object in the western sky just after sunset. It will be the evening star for the winter season. On December 31, Jupiter will set about two and a half hours after the sun.



THE CONSTELLATIONS AT 9:00 P. M. DECEMBER 1.

Saturn will not be in a position favorable for observation during December since conjunction with the sun will have occurred on November 21. On January 1 it will rise about three hours before the sun.

Uranus is in Pisces and is in a position favorable for evening observation. On December 18 it will be in quadrature with the sun.

Neptune is a morning object during December and is in Leo about 10 minutes of time west of Regulus. At the beginning of the month Neptune will rise just before midnight.

Mars.

This planet, because during the month of November it will be very favorably situated for observation, deserves special mention. Its favorable position is due to the fact that on November 4 it will be at opposition with the sun. This means that on this date the sun, earth, and Mars will be approximately in a straight line, the earth being between the other two. Consequently at this season this planet is again relatively near the earth. On October 27 the distance between the earth and Mars was about 42,000,000 miles. The motions of these two planets during the month of November will increase this distance by about 10,000,000 miles. Because of its relative nearness it is very bright, and therefore easily distinguished from the stars. It is the brilliant object in the eastern sky in the evening, near the meridian at midnight and remaining visible in the western sky practically until day break.

At its former close approach in 1924 a great amount of study was expended upon it, and as a result the conclusion that in some respects the surface conditions on Mars are not wholly unlike those on the earth seems to be justified. This being so, the supposition of life on Mars is not so fanciful as it might have seemed at one time. The research observatories will during this month be busily engaged in again seeking to obtain new information concerning our nearest neighbor and the results of these efforts will be awaited eagerly by astronomers and layman alike.

Occultations Visible at Washington.

[From the *American Ephemeris.*]

Date 1926	Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Dec. 7	49 Sagittarii	5.5	18 22	157	18 34	179	0 12
9	128 B. Capricorni	6.5	21 2	149	21 11	167	0 9
11	290 B. Aquarii	6.3	17 3	0	17 43	300	0 40
12	24 B. Ceti	6.0	17 55	53	19 13	240	1 18
17	162 B. Tauri	6.3	4 9	12	4 30	328	0 21
19	141 Tauri	6.3	7 9	26	7 30	338	0 21
21	192 B. Geminorum	6.3	0 20	121	1 40	249	1 20

VARIABLE STARS.

Medal for Observers of Variable Stars. — In the *Bulletin of the Observatory of Lyons* for September 1926, the announcement is made that Mr. W. N. Abbot had recently presented one thousand francs to the University of Lyons, the income from which is to be used to provide a silver medal to be awarded annually to an observer of variable stars. The award is to be limited to those observers whose investigations are centralized at the Observatory of the University of Lyons.

Mr. Abbot is to be commended for his generosity in thus promoting interest in this important branch of astronomical work.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1926							
					December							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8								
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	5 22	13 14	21 7	28 23				
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	7 10	14 22	22 10	29 22				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	5 12	11 15	23 20	29 23				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	9 0	17 14	26 4					
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	2 5	9 1	22 19	29 16				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	3 18	10 22	18 2	25 6				
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	1 11	10 6	19 2	27 20				
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	2 4	10 2	18 1	26 0				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6				29 12				
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	3 22	12 13	21 3	29 17				
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	4 13	11 9	24 23	31 18				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	1 13	9 11	17 9	25 6				
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	2 4	10 11	18 19	27 2				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	8 9	16 7	24 4					
RW Persei	13.3	+42 04	8.8—11.0	13 04.8		12 14		25 19				
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	4 13	10 20	23 11	29 18				
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	4 1	16 11	28 21					
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	3 1	9 17	23 1	29 17				
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	3 22	12 2	20 7	28 11				
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	3 20	9 21	21 22	27 22				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	5 4	13 20	22 12	31 4				
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	8 0	18 11	28 20					
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	6 7	14 7	22 8					
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	3 17	9 11	20 22	26 15				
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	2 7	13 12	19 3	30 7				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	2 3	10 8	18 12	26 17				
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	5 17	13 8	20 23	28 12				
RX Gemin.	43 6	+33 21	8.8— 9.6	12 05.0	6 2	28 10	30 15					
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	6 20	14 1	21 5	28 9				
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	7 9	14 5	21 1	27 20				
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	1 17	10 23	20 7	29 14				
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	5 3	11 18	24 23	31 14				
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	5 11	13 20	22 6	30 15				
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	3 14	10 1	22 21	29 7				
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	3 23	11 6	18 12	25 19				
X Carinæ	8 29.1	—58 53	7.9— 8.7	0 13.0	4 16	12 18	20 21	29 1				
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	4 20	14 8	23 20					
RX Hydræ	9 00.8	— 7 52	9.1—10.5	2 06.8	7 23	14 20	21 16	28 13				
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	3 14	9 12	21 9	27 8				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	3 6	10 0	23 12	30 6				
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	3 2	10 12	17 22	25 8				
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	5 12	12 2	25 7	31 22				
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	5 23	14 16	23 12					
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	7 23	15 7	22 15	29 23				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	7 6	14 1	20 19	27 14				
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	4 4	11 17	19 5	26 17				
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	6 3	15 17	25 8					
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	5 18	13 5	20 15	28 2				

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1926 December							
	h m	° ′		d h	d	h	d	h	d	h	d	h
SX Hydræ	13 39.0	−26 23	8.6—12.7	2 21.5	6	16	12	11	24	1	29	20
δ Libræ	14 55.6	− 8 07	4.8— 6.2	2 07.9	6	16	13	16	20	15	27	15
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	4	7	11	4	25	0	31	21
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	3	22	12	9	20	19	29	5
SS Libræ	15 43.4	−15 14	9.3—11.5	0 18.4	3	7	10	12	17	16	24	21
SW Ophiuchi	16 11.1	− 6 44	9.2—10.0	2 10.7	6	1	13	9	20	17	28	1
SX Ophiuchi	12.6	− 6 25	10.5—11.2	2 01.5	7	23	16	5	24	11		
R Aræ	31.1	−56 48	6.8— 7.9	4 10.2	8	9	17	5	26	2		
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	7	12					28	6
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	5	17	12	12	19	7	26	3
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	1 16.2	5	16	14	2	22	11	30	20
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	5	20	11	23	24	7	30	10
TX Herculis	15.4	+42 00	8.3— 9.0	2 01.4	4	19	10	23	23	7	29	12
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	3	7	10	16	18	1	25	10
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	3	9	11	13	19	17	27	22
TX Scorpii	48.6	−34 13	7.5— 8.2	0 22.6	8	7	15	20	23	9	30	22
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	4	23	12	17	20	11	28	5
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	3	14	11	14	19	13	27	13
WX Sagittarii	53.6	−17 24	9.2—10.8	2 03.1	3	9	11	22	19	10	28	23
WY Sagittarii	17 54.9	−23 01	9.5—10.6	4 16.0	3	8	12	16	22	0	31	9
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	6	1	16	9	21	13	31	21
RS Sagittarii	11.0	−34 08	5.9— 6.3	2 10.0	5	12	12	18	20	0	27	6
V Serpentis	11.1	−15 34	9.5—11.1	3 10.9	3	4	10	1	23	21	30	18
RZ Scuti	21.1	− 9 15	7.4— 8.3	15 03.2			10	11			25	13
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	2	19	9	23	24	7	31	11
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	2	12	9	15	23	21	30	23
SX Sagittarii	39.7	−30 36	8.7— 9.8	2 01.8	2	15	10	22	19	5	27	12
RR Draconis	40.8	+62 34	9.3—13	2 19.9	8	0	16	12	25	0		
RS Scuti	43.7	−10 21	9.3—10.3	0 15.9	2	4	8	19	22	2	28	18
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	8	22			21	19		
U Scuti	18 48.9	−12 44	9.1— 9.6	0 22.9	2	9	10	0	17	15	25	7
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	2	5	9	19	17	9	24	23
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	7	21	15	2	22	6	29	11
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	1	23	10	22	19	21	28	20
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	5	14	12	9	19	3	25	21
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	2	17	10	2	17	10	24	19
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	1	11	11	22	17	4	27	16
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	1	12	8	1	21	2	27	15
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	4	15	10	15	22	15	28	15
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	4	18	11	9	18	0	24	15
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	2	8	11	12	20	15	29	19
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	5	8	13	18	22	5	30	15
RW Capric.	12.2	−17 59	8.8—10.6	3 09.4	4	7	11	2	24	16	31	11
UW Cygni	19.6	+42 55	10.5—13	3 10.8	2	22	9	19	23	15	30	12
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0							26	21
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	4	13	14	3	18	23	28	13
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	7	20	17	1	26	5		
Y Cygni	48.1	+34 17	7.1— 7.9	2 23.9	2	0	11	0	19	23	28	23
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	6	0	13	14	21	4	28	19
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	9	15	19	17	29	20		
RY Aquarii	21 14.8	−11 14	8.8—10.4	1 23.2	5	9	13	6	21	3	28	23
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3	4	1						
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	2	15	12	19	17	21	29	0
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	3	20	14	5	19	9	29	18
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	4	0	14	12	19	19	30	8
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	2	23	10	12	18	1	25	14
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	9	6	17	12	25	18		

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5h; Central Standard time 6h. etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1926							
					December							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7			10 20					
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	7 5		15 8		23 12		31 15	
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	6 2		13 19		21 13		29 7	
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2			12 14				27 10	
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	5 17		13 15		21 14		29 13	
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	1 16		9 11		17 6		25 1	
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0			11 13				27 23	
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	5 23		14 12		23 2		31 16	
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	3 10		14 13		25 16			
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0			11 16		23 7			
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	4 12		12 4		19 20		27 12	
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	9 1		19 4		29 7			
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	3 11		11 4		18 22		26 15	
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	5 3		10 16		21 17		27 6	
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	8 1		15 14		23 3		30 17	
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3			18 10					
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	3 18		11 5		18 16		26 3	
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	5 21		13 19		21 18		29 16	
ξ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	4 6		14 10		24 13			
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5	8 6						30 6	
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	6 23		14 22		22 20		30 19	
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	5 16		12 9		19 2		25 19	
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	3 18		13 1		22 7		31 14	
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	6 16		15 10		24 4			
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7							30 1	
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	4 9		11 3		24 17		31 12	
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	3 13		10 4		23 9		30 0	
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8			10 12		20 4		29 20	
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	8 1		16 1		24 0		31 23	
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	1 2		7 20		21 8		28 2	
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	4 10		10 6		21 22		27 18	
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	2 18		12 3		21 12		30 21	
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5			17 14					
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	7 17		15 22		24 3			
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	4 18		11 18		19 19		26 19	
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	6 9		13 18		21 5		28 14	
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	4 16		10 4		21 4		26 15	
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	5 7		12 20		20 9		27 22	
R Trian.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	1 2		7 20		20 10		28 4	
S Trian.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	6 8		12 16		25 7		31 15	
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1			10 11		20 5		29 23	
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6			8 0		16 21		25 17	
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	3 9		9 10		21 13		27 15	
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	1 1		8 1		22 1		29 2	
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9	6 17				23 19			
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	1 12		9 2		24 7		31 21	
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	1 14		13 3		18 22		30 11	
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	7 5		13 23		20 17		27 11	
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	4 0		14 9		24 18			
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	4 11		12 3		19 19		27 11	
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	1 22		9 9		24 6		31 16	
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	8 0		17 2		26 4			
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	7 18		14 18		21 19		28 19	
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	6 4		13 4		20 4		27 4	

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1926 December							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	4 2	12 2	20 1	28 1				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	5 16	13 9	21 1	28 18				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	3 3	10 7	17 11	24 15				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	8 12	16 21	25 6					
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	1 11	7 19	20 10	26 17				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	6 3		22 12					
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	4 23	13 19	22 16	31 13				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	5 10	12 17	20 0	27 7				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	5 0	12 4	19 8	26 12				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	1 10	16 3		30 20				
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	1 14	9 11	17 7	25 4				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	6 5	13 3	20 1	26 21				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	4 8	14 2	18 23	28 16				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	6 23	15 15	24 7					
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	5 4	10 13	21 6	26 15				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	8 1	18 23		29 20				
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	2 23	9 9	22 4	28 14				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	4 22	14 21	19 20	29 20				
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	2 12	13 9	18 20	29 17				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	4 12	15 9	20 20	31 17				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	1 14	7 21	20 11	26 19				
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	4 21	17 1	29 4					
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	5 7	12 7	19 7	26 6				

Monthly Report of the American Association of Variable Star Observers, for the Month ending September 30, 1926.

With the fall season now on, we look for more extended reports from still more observers, old and new. The three interesting SS Cygni type variables have been in the lime light recently, thanks to the diligence of such observers as Cunningham and Peltier.

It is a pleasure to report the progress of some of our members. Miss Helen C. Howarth, formerly at Smith College, has assumed charge of the course in astronomy at Hood College, Frederick, Md., with the rank of Assistant Professor. With the fine 8-inch refractor recently erected, we hope that some fine variable star observations may be forthcoming at the hands of Professor Howarth and her pupils. Dr. D. H. Menzel, formerly of Denver and Princeton, has gone to Lick Observatory as assistant astronomer. Mr. W. F. H. Waterfield has joined the staff of the Harvard Observatory. Thus more of our amateur observers have turned "Pro." Fortunately, the severe storm at Miami did not injure the telescopic equipment belonging to the Southern Cross Observatory, and Mr. Rhorer expects to function there again this winter.

The Harvard Radio Talks, some of which were reprinted in *Science Monthly* and elsewhere, have been the means of arousing considerable interest in our organization, and Secretary Olcott reports almost daily requests for further information regarding our work.

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926.

July 0 = J. D. 2424697; Aug. 0 = J. D. 2424728; Sept. 0 = J. D. 2424759.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
001032 S SCULPTORIS—						
	4713.4	10.4	Ht	4769.8	8.7	Pt
001046 X ANDROMEDAE—						
	4756.7	9.5	Pw	4767.6	9.7	B
	4770.7	9.8	Pw	4773.6	10.0	Ie
001620 T CETI—						
	4682.3	6.7	Kd	4738.6	6.4	L
	4711.2	6.6	Kd	4756.6	6.7	L
001726 T ANDROMEDAE—						
	4730.2	9.8	Ch	4769.8	11.7	Pt
	4738.7	9.8	Pt	4771.6	11.8	O
	4756.7	10.9	Pw	4773.5	11.8	Ie
001755 T CASSIOPEIAE—						
	4737.2	12.0	Ch	4769.8	12.2	Pt
	4738.7	12.2	Pt	4771.6	12.6	O
	4743.5	12.1	L	4773.6	12.0	Ie
	4754.4	12.0	L	4775.6	11.3	Bx
	4766.8	12.1	Sg			
001838 R ANDROMEDAE—						
	4704.1	7.6	Kk	4738.7	7.8	Pt
	4705.1	7.7	Kk	4746.7	8.2	Jo
	4712.1	7.4	Kk	4758.6	8.3	Jo
	4714.1	7.4	Kk	4765.4	9.4	Lp
	4730.2	7.6	Ch	4769.7	8.7	Jo
	4731.7	7.6	Gb	4769.8	9.1	Pt
	4736.7	8.0	Jo	4773.5	9.3	Ie
001909 S CETI—						
	4731.3	8.5	Ch	4756.6	9.4	L
	4738.7	9.2	Pt	4769.8	10.0	Pt
	4741.6	8.9	L			
004047 U CASSIOPEIAE—						
	4738.7	10.9	Pt	4769.8	13.3	Pt
004132 RW ANDROMEDAE—						
	4731.2	[11.0	Ch			
004435 V ANDROMEDAE—						
	4770.6	12.3	O			
004746a RV CASSIOPEIAE—						
	4738.7	9.7	Pt	4773.6	10.7	O
	4769.8	10.7	Pt			
004746b — CASSIOPEIAE—						
	4738.7	10.7	Pt	4769.8	10.5	Pt
004958 W CASSIOPEIAE—						
	4738.7	8.0	Pt	4769.8	8.7	Pt
	4765.5	8.5	Lp	4773.6	10.7	O
005475 U TUCANAE—						
	4708.3	[12.9	Sm	4724.3	[12.9	Sm
	4713.4	[12.9	Sm	4727.3	[12.5	En
005840 RX ANDROMEDAE—						
	4732.7	[12.4	Pt	4766.6	13.5	Pt
	4736.6	[11.7	Pt	4768.8	[11.7	Pt
	4738.7	[11.7	Pt	4769.6	[12.4	Pt
	4747.8	11.3	Pt	4770.6	[12.4	Pt
	4755.7	[11.7	Pt	4772.6	13.1	Pt
	4756.6	[11.7	Pt	4773.7	[11.7	Pt
	4758.6	[12.6	Pt	4776.6	[11.7	Pt
	4765.6	11.9	Pt			
010102 Z CETI—						
	4769.8	12.7	Pt			
011041 UZ ANDROMEDAE—						
	4773.6	11.8	O	4773.6	11.7	Ie
011272 S CASSIOPEIAE—						
	4770.6	12.1	Ie			
011712 U PISCIUM—						
	4747.8	12.8	Pt			
013238 RU ANDROMEDAE—						
	4731.2	11.0	Ch	4767.6	11.0	Jo
	4747.8	10.5	Pt	4769.8	10.6	Pt
013338 Y ANDROMEDAE—						
	4731.2	10.0	Ch	4767.7	9.5	Jo
	4747.8	9.0	Pt	4769.8	9.1	Pt
014958 X CASSIOPEIAE—						
	4728.5	12.7	Bn	4747.8	13.0	Pt
	4734.4	12.6	Bn	4756.4	12.4	Bn
	4742.4	12.7	Bn	4769.8	12.1	Pt
015254 U PERSEI—						
	4747.8	8.9	Pt	4769.8	8.8	Pt
015912 S ARIETIS—						
	4769.8	13.5	Pt			
021024 R ARIETIS—						
	4734.8	11.0	Wb	4765.5	13.0	Lp
	4747.8	12.5	Pt	4769.8	13.3	Pt
021143a W ANDROMEDAE—						
	4769.8	13.2	Pt			
021258 T PERSEI—						
	4747.8	8.5	Pt	4769.8	8.4	Pt
021403 o CETI—						
	4736.8	7.3	Cy	4769.8	5.8	Pt
	4741.6	7.1	L	4770.3	6.2	Gs
	4747.8	7.5	Pt	4770.7	5.5	Pw
	4756.6	7.1	L	4777.8	4.8	Cu
021558 S PERSEI—						
	4704.2	8.9	Kk	4758.3	9.3	Kl
	4714.1	8.9	Kk	4762.3	9.3	Kl
	4733.4	9.1	Kl	4765.5	9.0	Lp
	4747.8	8.6	Pt	4769.8	8.6	Pt
022813 U CETI—						
	4519.9	9.0	Kk	4530.9	8.8	Kk
	4524.9	9.0	Kk	4531.9	8.7	Kk
	4526.0	8.7	Kk	4747.8	9.2	Pt
	4529.9	8.8	Kk	4769.8	7.9	Pt
022980 RR CEPHEI—						
	4777.7	11.1	Cu			
023133 R TRIANGULI—						
	4736.8	9.0	Jo	4757.7	10.0	Jo
	4736.8	9.3	Cy	4769.8	10.9	Pt
	4747.8	9.6	Pt	4773.6	11.3	Ie
024356 W PERSEI—						
	4736.8	9.8	Cy	4769.7	9.9	Cm
	4747.8	9.1	Pt	4769.8	9.3	Pt
031401 X CETI—						
	4741.6	9.3	L	4756.6	10.6	L
	4747.8	10.3	Pt	4769.8	10.7	Pt
032043 Y PERSEI—						
	4742.8	8.5	Gb	4765.7	8.4	Gb
	4747.8	8.3	Pt	4769.8	8.3	Pt
032335 R PERSEI—						
	4747.8	9.1	Pt	4769.8	8.5	Pt
042209 R TAURI—						
	4747.8	12.1	Pt	4769.8	13.8	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
042215 W TAURI—						
	4747.8	11.5	Pt	4769.8	12.1	Pt
042309 S TAURI—						
	4769.8	13.4	Pt			
043065 T CAMELOPARDALIS—						
	4737.3	8.3	L	4758.7	8.5	Jo
	4747.8	8.6	Pt	4769.8	9.1	Pt
	4752.3	8.5	L			
043263 R RETICULI—						
	4709.9	8.2	Bl			
043274 X CAMELOPARDALIS—						
	4747.8	12.3	Pt	4771.6	12.3	O
	4769.8	12.1	Pt	4777.7	11.9	Cu
043562 R DORADUS—						
	4707.9	6.3	Bl			
044617 V TAURI—						
	4747.8	9.6	Pt	4769.8	9.8	Pt
045514 R LEPORIS—						
	4519.9	9.5	Kk	4558.9	9.5	Kk
	4525.0	9.4	Kk	4741.6	8.3	L
	4526.0	9.5	Kk	4756.6	8.8	L
	4531.9	9.7	Kk	4769.8	8.9	Pt
	4542.9	9.5	Kk			
050003 V ORIONIS—						
	4769.8	12.6	Pt			
050953 R AURIGAE—						
	4747.8	9.3	Pt	4769.8	9.0	Pt
	4768.9	8.8	Bi			
052034 S AURIGAE—						
	4747.8	8.2	Pt	4769.8	8.3	Pt
052036 W AURIGAE—						
	4769.8	10.0	Pt			
052404 S ORIONIS—						
	4769.8	12.5	Pt			
053005a T ORIONIS—						
	4519.9	10.5	Kk	4558.9	10.1	Kk
	4521.9	10.8	Kk	4580.9	10.8	Kk
	4523.9	10.9	Kk	4581.9	10.9	Kk
	4525.9	10.9	Kk	4582.9	10.1	Kk
	4529.9	9.7	Kk	4586.9	9.9	Kk
	4530.9	10.7	Kk	4610.0	9.7	Kk
	4531.9	10.7	Kk	4611.9	10.5	Kk
	4542.9	11.1	Kk	4612.9	10.1	Kk
	4543.9	11.2	Kk	4741.6	10.2	L
	4544.9	10.7	Kk	4752.8	11.0	Pt
	4553.9	10.1	Kk	4756.6	11.5	L
053068 S CAMELOPARDALIS—						
	4734.7	8.6	Pc	4758.7	8.1	Jo
	4747.8	8.3	Pt	4766.6	8.7	Pc
	4755.6	8.6	Pc	4769.8	8.4	Pt
053337 RU AURIGAE—						
	4747.8	[11.6	Pt	4769.8	9.0	Pt
	4755.9	9.0	Pc			
053531 U AURIGAE—						
	4769.8	11.0	Pt			
054319 SU TAURI—						
	4735.4	[10.1	Ch	4769.8	9.5	Pt
	4738.6	10.7	L	4770.8	9.5	Pt
	4741.6	10.6	L	4770.8	9.8	Cu
	4756.6	10.4	L	4772.7	9.9	Cu
	4752.8	10.1	Pt	4773.8	9.8	Cu
054319 SU TAURI—Continued.						
	4768.9	9.6	Bi	4777.8	9.9	Cu
	4769.7	9.9	Cu			
054920a U ORIONIS—						
	4735.4	8.1	Ch	4769.8	5.8	Pt
	4768.9	5.8	Bi			
054920b UW ORIONIS—						
	4768.9	10.5	Bi			
055353 Z AURIGAE—						
	4747.8	9.6	Pt	4765.6	9.9	Pt
	4749.7	10.5	Pt	4768.8	9.5	Pt
	4752.8	9.8	Pt	4769.8	9.9	Pt
	4758.6	9.9	Pt			
055686 R OCTANTIS—						
	4708.3	11.8	Sm	4728.0	12.0	Bl
060450 X AURIGAE—						
	4769.8	9.0	Pt	4775.9	10.0	Pc
060547 SS AURIGAE—						
	4736.8	10.8	Cy	4768.8	[12.6	Pt
	4738.6	11.3	L	4768.9	[13.9	Bi
	4741.6	13.7	L	4769.8	[12.6	Pt
	4743.5	[13.3	L	4770.8	[12.4	Pt
	4752.8	[11.0	Pt	4772.7	11.1	Cu
	4756.6	[12.4	L	4773.8	11.4	Cu
	4765.5	[12.4	Lp	4774.7	11.4	Cu
063308 R MONOCEROTIS—						
	4769.8	10.6	Pt			
063462 NOVA PICTORIS—						
	4707.9	5.7	Bl	4725.9	5.5	Bl
063558 S LYNCIS—						
	4769.8	9.8	Pt			
064707 W MONOCEROTIS—						
	4769.8	10.4	Pt			
065208 X MONOCEROTIS—						
	4756.6	8.9	L			
065111 Y MONOCEROTIS—						
	4768.9	11.5	Bi	4769.8	11.3	Pt
070122a R GEMINORUM—						
	4769.8	13.7	Pt			
070122b TW GEMINORUM—						
	4769.8	8.0	Pt			
070122c Z GEMINORUM—						
	4769.8	12.5	Pt			
070310 R CANIS MINORIS—						
	4756.6	8.6	L			
070772 R VOLANTIS—						
	4708.3	12.9	Sm	4724.2	12.8	Sm
	4709.2	12.6	Ht	4724.2	[12.6	Ht
	4713.2	12.6	Ht			
071713 V GEMINORUM—						
	4769.8	9.6	Pt			
072708 S CANIS MINORIS—						
	4582.0	7.4	Kk	4587.0	7.4	Kk
	4583.0	7.4	Kk	4612.9	8.1	Kk
	4584.0	7.4	Kk	4756.6	11.7	L
	4586.0	7.4	Kk	4769.9	11.3	Pt
073173 S VOLANTIS—						
	4698.0	13.0	Bl	4728.0	[13.2	Bl
073508 U CANIS MINORIS—						
	4756.6	10.7	L	4769.9	11.1	Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
074241 W PUPPIS—						
	4704.2	8.5	Sm	4709.2	8.5	Ht
	4707.9	8.7	Bl	4713.2	8.5	Ht
	4709.2	8.5	Sm			
074922 U GEMINORUM—						
	4756.6	[12 4	L	4772.8	11.5	Cu
	4769.9	9.2	Pt	4773.8	11.8	Cu
	4770.8	9.3	Cu	4777.8	13.6	Cu
081112 R CANCRI—						
	4581.9	6.8	Kk	4586.9	6.8	Kk
	4582.9	6.9	Kk	4606 9	6.5	Kk
	4583.9	6.9	Kk	4612.9	6 6	Kk
	4586.0	6.9	Kk	4769.9	10.8	Pt
081716 V CANCRI—						
	4769.9	9.2	Pt			
082476 R CHAMAELEONTIS—						
	4699.2	9.9	En	4707.2	10.2	En
	4704.3	9.9	Sm	4711.2	10.6	En
	4707.9	9.6	Bl	4724.2	10 8	Sm
	4709.2	10.6	Sm	4725.9	10.6	Bl
083350 X URSAE MAJORIS—						
	4769.9	10.1	Pt			
085008 T HYDRAE—						
	4582.0	9.8	Kk	4586.1	9.7	Kk
	4583.0	9.6	Kk	4587.0	9.8	Kk
	4584.0	9.6	Kk			
085120 T CANCRI—						
	4769.9	8 6	Pt			
001868 RW CARINAE—						
	4698.0	12.6	Bl	4728.0	[12.8	Bl
092551 Y VELORUM—						
	4698.0	[12.9	Bl	4724.2	[12.1	Sm
	4704.2	[12.9	Sm	4725.9	[12.4	Bl
	4707.9	[13.0	Bl			
092962 R CARINAE—						
	4700.3	5.9	En	4713.2	4.9	Ht
	4704.3	5.5	Sm	4720.2	4.5	Ht
	4706.3	5.4	En	4724.2	5.2	Ht
	4707.9	5.2	Bl	4724.2	5.6	En
	4708.3	5.2	Ht	4724.2	5.5	Sm
	4709.3	5.4	Sm	4725.9	5.4	Bl
	4711.2	5.3	En			
093934 R LEONIS MINORIS—						
	4769.9	10.8	Pt			
094211 R LEONIS—						
	4520.2	8.0	Kk	4576.9	6.1	Kk
	4522.1	7.8	Kk	4578.3	6.1	Kk
	4525.1	7.6	Kk	4580.9	6.2	Kk
	4530.1	7.4	Kk	4581.9	6.3	Kk
	4533.3	7.3	Kk	4582.9	6 1	Kk
	4537.0	7.2	Kk	4583.9	6.2	Kk
	4539.0	7.1	Kk	4585.0	6.4	Kk
	4540 0	7.1	Kk	4585.9	6.3	Kk
	4541.0	7.0	Kk	4586.9	6.3	Kk
	4542.3	6 9	Kk	4590.9	6.4	Kk
	4545.3	6.8	Kk	4592.9	6.4	Kk
	4547.9	6.8	Kk	4595.9	6.5	Kk
	4552.1	6.5	Kk	4597.9	6.6	Kk
	4554.2	6.6	Kk	4600.9	6.6	Kk
	4556.9	6.4	Kk	4602.9	6 6	Kk
	4558.9	6.2	Kk	4606.9	6.8	Kk
094211 R LEONIS—Continued.						
	4562.9	6.2	Kk	4610.0	6.8	Kk
	4566.0	6.1	Kk	4612.9	6.8	Kk
	4569.9	6.0	Kk	4622.0	7.0	Kk
	4570.9	5 9	Kk	4635.0	7.3	Kk
	4571.9	6.0	Kk	4643.9	7.6	Kk
	4572.9	6.0	Kk	4650.9	7.5	Kk
094953 Z VELORUM—						
	4698.0	12.5	Bl	4713.2	[12.1	Ht
	4700.3	[12.2	En	4724.2	[12.1	Sm
	4704.2	[12.1	Sm	4724.2	[12 1	Ht
	4706.3	[12.2	En	4724.2	[12.2	En
	4708.3	[12.1	Ht	4728.0	[12.8	Bl
	4711.2	[12.2	En			
095563 RV CARINAE—						
	4698.0	[13.1	Bl			
100661 S CARINAE—						
	4700.3	7.9	En	4713.2	6.9	Ht
	4704.3	7.5	Sm	4714.3	6.8	Sm
	4706.3	7.5	En	4720.2	6.8	Ht
	4707.9	7.0	Bl	4724.2	6.5	Sm
	4708.3	7.3	Ht	4724.2	6.7	Ht
	4709.3	7.0	Sm	4724.2	6.8	En
	4711.2	6.7	En	4725.9	6 3	Bl
101058 Z CARINAE—						
	4698.0	[12.6	Bl	4707.2	[12.3	En
	4700.3	[12.3	En	4711.2	[12.3	En
	4704.3	[12.3	Sm	4724.2	[12.3	En
101153 W VELORUM—						
	4698.0	[13.0	Bl	4724.2	[12.0	Sm
	4704.2	[12 0	Sm			
103212 U HYDRAE—						
	4636.9	5.9	Kd	4677.0	5.4	Kd
	4644.0	5.5	Kd	4683.0	5.4	Kd
	4675.0	5.5	Kd			
103769 R URSAE MAJORIS—						
	4755.6	8.1	Pc	4769.6	8.4	Cm
	4769.6	8.0	Pc	4769.9	7.8	Pt
104620 W HYDRAE—						
	4707.9	9 0	Bl	4725.9	8.8	Bl
104628 RS HYDRAE—						
	4707.9	10.4	Bl	4725.9	10.8	Bl
110361 RS CARINAE—						
	4700.3	[12.1	En	4711.2	[12.1	En
	4704.3	[12.3	Sm	4724.2	[12.3	Sm
	4707.2	[12.1	En	4724.2	[12.1	En
111561 RY CARINAE—						
	4698.0	[13.1	Bl			
111661 RS CENTAURI—						
	4704.3	9 0	Sm	4724.2	9.5	Sm
	4707.9	9.1	Bl	4725.9	9.2	Bl
	4709.3	8.6	Sm			
114441 X CENTAURI—						
	4707.9	8.3	Bl	4725.9	8.9	Bl
115058 W CENTAURI—						
	4707.9	10.9	Bl	4725.9	11.8	Bl
122001 SS VIRGINIS—						
	4729.3	7.2	L	4743.3	7.6	L
122532 T CANUM VENATICORUM—						
	4734.7	9.9	Pc	4755.6	10.1	Pt
	4755.6	9.9	Pc	4768.6	9.9	Pc

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
122854 U CENTAURI—						
	4698.0	10.9	Bl	4725.9	8.8	Bl
	4707.9	10.0	Bl			
123160 T URSAE MAJORIS—						
	4578.1	8.9	Kk	4604.9	8.3	Kk
	4581.9	8.8	Kk	4607.0	8.5	Kk
	4582.9	8.8	Kk	4610.0	8.4	Kk
	4584.0	8.8	Kk	4611.0	8.3	Kk
	4586.0	8.7	Kk	4612.9	8.7	Kk
	4586.9	8.8	Kk	4618.0	8.7	Kk
	4590.0	8.7	Kk	4623.1	9.0	Kk
	4590.9	8.7	Kk	4632.0	9.1	Kk
	4592.9	8.5	Kk	4639.0	9.4	Kk
	4595.9	8.5	Kk	4650.9	9.6	Kk
	4597.9	8.5	Kk	4723.1	[10.7	Ch
	4600.9	8.3	Kk	4755.6	12.8	Pt
	4601.9	8.4	Kk	4763.6	[13.0	B
	4602.9	8.3	Kk			
123307 R VIRGINIS—						
	4730.3	10.2	L	4743.3	[9.6	L
123459 RS URSAE MAJORIS—						
	4723.1	11.0	Ch	4755.6	8.4	Pt
	4731.6	10.0	Cy	4758.6	9.1	Jo
	4736.6	8.8	Jo	4758.7	9.6	Sg
	4736.7	8.9	Cy	4766.6	8.9	Wb
	4740.6	8.8	Cy	4769.6	8.6	Jo
	4743.6	8.6	Jo	4770.5	9.1	Ie
123961 S URSAE MAJORIS—						
	4578.1	10.4	Kk	4743.6	8.3	Jo
	4581.9	10.6	Kk	4743.6	8.3	Jn
	4582.9	10.7	Kk	4750.3	8.0	L
	4584.0	10.7	Kk	4753.4	8.6	Kl
	4586.0	10.7	Kk	4755.6	8.6	Pc
	4586.9	10.9	Kk	4755.6	8.3	Pt
	4699.0	8.4	Kk	4756.4	8.7	An
	4702.0	8.6	Kk	4756.4	8.2	L
	4703.9	8.5	Kk	4756.4	8.7	An
	4714.1	8.4	Kk	4757.3	8.6	Kl
	4723.1	8.1	Ch	4758.3	8.7	Kl
	4731.7	8.0	Gb	4758.6	8.6	Wb
	4733.4	8.2	Kl	4758.6	8.4	Jo
	4735.5	8.0	Pw	4758.7	8.5	Sg
	4735.7	8.3	Wb	4760.3	8.8	Kl
	4736.6	7.8	Jo	4762.3	8.8	Kl
	4736.7	7.7	Cy	4763.5	9.1	B
	4737.3	7.7	L	4765.4	9.0	Lp
	4737.4	8.3	Kl	4769.6	8.8	Pc
	4738.4	8.4	An	4769.6	8.7	Jo
	4738.4	8.4	An	4769.7	8.9	Cm
	4740.4	8.4	Kl	4774.6	9.1	Pw
131283 U OCTANTIS—						
	4707.9	11.6	Bl	4713.4	12.0	Sm
	4708.3	11.2	Sm	4724.2	12.4	Ht
	4708.3	11.8	Ht	4725.9	12.2	Bl
	4713.3	12.0	Ht			
132422 R HYDRAE—						
	4637.0	7.2	Kd	4707.0	4.5	Kd
	4643.1	7.3	Kd	4707.2	4.8	En
	4644.0	7.2	Kd	4707.9	4.8	Bl
	4671.0	5.2	Kd	4709.0	4.7	Kd
	4675.0	5.3	Kd	4709.3	4.4	Sm
	4676.0	5.1	Kd	4711.0	4.5	Kd
132422 R HYDRAE—Continued.						
	4677.0	5.0	Kd	4712.3	4.8	En
	4682.0	4.9	Kd	4724.2	4.9	Sm
	4683.0	4.9	Kd	4724.3	4.8	En
	4699.2	4.8	En	4725.9	4.9	Bl
	4700.0	4.5	Kd	4727.0	4.8	Kd
	4704.3	4.4	Sm	4731.1	5.4	Ch
	4705.0	4.6	Kd			
132706 S VIRGINIS—						
	4708.3	8.4	Sm	4724.3	9.0	Sm
	4713.4	8.8	Sm	4733.1	9.3	Ch
133155 RV CENTAURI—						
	4707.9	9.3	Bl	4725.9	9.7	Bl
133633 T CENTAURI—						
	4637.0	6.8	Kd	4707.9	6.0	Bl
	4643.1	6.8	Kd	4708.3	6.4	Sm
	4644.0	7.0	Kd	4708.3	6.1	Ht
	4671.0	6.7	Kd	4709.0	6.3	Kd
	4675.0	6.5	Kd	4710.0	6.3	Kd
	4676.0	6.4	Kd	4711.0	6.3	Kd
	4677.0	6.3	Kd	4712.3	6.7	En
	4682.0	6.2	Kd	4713.3	6.5	Ht
	4683.0	6.2	Kd	4713.4	6.0	Sm
	4684.0	6.1	Kd	4724.3	7.1	Sm
	4699.3	6.2	Ht	4724.3	7.2	Ht
	4700.2	5.8	En	4724.3	7.1	En
	4707.0	6.2	Kd	4725.9	7.3	Bl
	4707.3	6.0	En	4727.0	7.2	Kd
134236 RT CENTAURI—						
	4707.9	9.0	Bl	4725.9	9.6	Bl
134440 R CANUM VENATICORUM—						
	4755.6	7.6	Pt	4765.4	7.6	Lp
	4763.7	7.7	B	4767.6	7.5	Ie
134536 RX CENTAURI—						
	4707.9	9.3	Bl	4725.9	9.6	Bl
134677 T APODIS—						
	4707.9	11.9	Bl	4724.3	12.7	Sm
	4708.3	11.7	Sm			
140113 Z BOOTIS—						
	4769.5	9.9	Ie			
140528 RU HYDRAE—						
	4698.0	[13.5	Bl	4708.3	[12.9	Sm
	4701.2	12.5	En	4727.3	[12.5	En
140959 R CENTAURI—						
	4700.3	8.0	En	4713.4	8.3	Sm
	4707.3	8.1	En	4720.2	8.1	Ht
	4707.9	8.0	Bl	4724.3	8.3	Ht
	4708.3	8.1	Ht	4724.2	8.2	En
	4711.2	8.1	En	4725.9	7.8	Bl
	4713.2	8.1	Ht			
141567 U URSAE MINORIS—						
	4730.6	10.5	Pw	4757.6	9.1	Pc
	4730.7	10.3	Lv	4759.6	9.2	Pw
	4734.7	10.6	Wb	4764.6	9.2	B
	4754.7	9.8	Wb	4767.7	9.0	Jo
	4755.6	9.7	Pt	4769.6	9.4	Jo
	4756.6	9.5	Bi	4769.6	9.4	Pc
	4757.2	9.5	Gs	4774.6	9.0	Pw
141954 S BOOTIS—						
	4736.7	12.2	Cy	4755.6	13.5	Pt
	4743.5	13.1	L	4757.3	13.3	L

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
142539a V BOOTIS—						
	4728.1	7.8	Ch	4736.7	7.7	Cy
	4730.3	7.8	L	4740.6	8.0	Cy
	4730.4	7.3	L	4755.6	7.9	Pt
	4731.6	7.9	Cy	4757.6	8.5	Pc
	4736.6	7.4	Jo	4765.4	8.6	Lp
142584 R CAMELOPARDALIS—						
	4764.6	11.5	B	4765.5	10.9	Lp
143227 R BOOTIS—						
	4736.7	[11.7	Cy	4767.6	12.0	Ie
	4755.6	12.5	Pt			
144918 U BOOTIS—						
	4732.7	10.9	Cy	4741.6	10.9	Cy
	4736.7	11.0	Cy			
145254 Y LUPI—						
	4707.9	10.1	Bl	4725.9	10.6	Bl
	4713.4	10.3	Sm			
145971 S APODIS—						
	4700.3	10.2	En	4713.4	10.2	Sm
	4707.3	10.2	En	4724.2	9.9	En
	4707.9	10.0	Bl	4724.3	10.4	Sm
	4708.3	10.4	Sm	4725.9	10.0	Bl
	4711.2	10.0	En			
150605 Y LIBRAE—						
	4730.3	9.4	L	4754.3	9.9	Be
	4743.3	9.5	L			
151520 S LIBRAE—						
	4728.1	8.4	Ch	4743.3	8.5	L
	4730.3	8.0	L	4755.6	8.5	Pt
	4830.3	8.4	An	4757.3	8.8	L
151714 S SERPENTIS—						
	4730.4	11.2	L	4756.5	7.9	Ie
	4750.3	8.0	L	4770.5	7.8	Ya
	4755.6	7.6	Pt			
151731 S CORONAE BOREALIS—						
	4729.2	[10.3	Ch	4758.7	12.2	Sg
	4755.6	12.0	Pc	4766.6	11.8	Pc
	4755.6	12.1	Pt	4771.6	10.9	B
151832 RS LIBRAE—						
	4700.2	8.6	En	4720.2	8.9	Ht
	4706.2	9.2	En	4724.3	8.3	Ht
	4708.0	8.5	Bl	4726.0	8.3	Bl
	4708.3	8.9	Ht	4726.3	8.9	En
	4709.2	8.3	Sm	4730.3	8.7	L
	4713.2	8.6	Ht	4730.3	8.7	Be
	4713.2	8.9	En	4730.3	8.2	An
	4714.2	8.1	Sm			
152714 RU LIBRAE—						
	4737.4	12.7	Be	4750.3	11.7	L
	4737.4	12.8	L	4755.6	12.2	Pt
152840 R NORMAE—						
	4698.0	7.4	Bl	4709.2	7.7	Sm
	4700.2	7.9	En	4713.2	7.5	En
	4706.2	8.0	En	4725.9	7.2	Bl
	4707.9	7.4	Bl	4727.3	7.8	En
153020 X LIBRAE—						
	4708.0	12.4	Bl			
153215 W LIBRAE—						
	4708.0	12.2	Bl	4737.4	13.3	L
153378 S URSAE MINORIS—						
	4736.7	12.7	Cy	4758.7	11.6	Sg
	4755.6	11.4	Pt	4772.5	10.8	Ya
153620a U LIBRAE—						
	4697.9	[12.9	Bl			
153654 T NORMAE—						
	4708.3	7.1	Ht	4720.2	7.5	Ht
	4709.2	7.2	Sm	4724.3	7.6	Ht
	4713.2	7.1	Ht			
154020 Z LIBRAE—						
	4697.9	11.9	Bl	4726.0	11.7	Bl
	4708.0	11.5	Bl			
154428 R CORONAE BOREALIS—						
	4636.9	6.3	Kd	4752.3	6.0	L
	4643.1	6.1	Kd	4753.3	6.0	L
	4671.0	6.1	Kd	4753.3	5.9	Be
	4674.0	6.1	Kd	4753.4	6.0	Kl
	4676.0	6.2	Kd	4753.6	6.1	Pt
	4682.0	6.1	Kd	4754.4	6.0	L
	4684.0	6.1	Kd	4755.6	6.0	Pw
	4700.0	6.0	Kd	4755.6	6.1	Pt
	4707.0	6.0	Kd	4755.6	6.2	Pc
	4723.1	6.1	Kd	4756.4	6.3	An
	4727.0	6.3	Kd	4756.6	6.0	Cm
	4729.7	6.1	Pt	4756.6	6.1	Pt
	4730.2	5.9	Ch	4757.3	6.1	Kl
	4730.4	5.9	Be	4757.3	5.9	L
	4730.4	6.2	An	4757.6	6.0	Pc
	4730.5	6.0	Pw	4758.4	5.9	L
	4731.6	5.9	Cy	4758.6	6.1	Pt
	4731.6	6.0	Pc	4758.6	6.0	Pc
	4731.7	6.5	Gl	4758.7	6.2	Sg
	4731.7	6.2	Sg	4759.4	5.9	L
	4731.7	6.2	Gl	4759.6	6.0	Pc
	4732.7	6.1	Pt	4759.6	6.1	Pw
	4733.4	5.8	Kl	4762.3	6.7	Kl
	4733.6	6.0	Pc	4765.6	6.1	Pt
	4734.6	6.0	Pc	4765.6	6.1	Pc
	4735.6	6.2	Gb	4766.6	6.0	Wb
	4735.6	6.0	Pc	4766.6	6.1	Pt
	4736.6	6.1	Pw	4766.6	6.2	Pc
	4736.6	6.0	Pc	4767.6	6.2	Pc
	4736.6	5.8	Jo	4767.6	6.3	Cl
	4736.6	6.1	Pt	4768.6	6.1	Pc
	4736.7	5.8	Cy	4769.6	6.3	Pc
	4737.2	5.9	Ch	4769.6	6.2	Pt
	4737.3	6.0	Be	4769.6	6.0	Cm
	4737.4	5.9	Kl	4770.6	6.0	Ya
	4737.6	6.0	L	4770.6	6.2	Pt
	4737.6	6.1	Pt	4771.6	6.0	O
	4738.7	6.0	Cy	4771.6	6.1	Pc
	4741.6	5.9	Cy	4772.6	6.2	Pc
	4742.6	6.0	Pc	4772.6	6.2	Pt
	4743.4	6.0	Be	4774.6	6.0	Pw
	4743.6	5.8	Jo	4775.6	6.2	Pc
	4744.7	5.9	Cy	4775.6	6.1	Pt
	4746.6	6.3	Cl	4776.6	6.2	Pc
	4746.7	6.1	Pt	4776.6	6.1	Pt
	4747.6	6.1	Pt	4777.5	6.1	Cu
	4749.7	6.1	Pt	4783.6	6.0	Cm
154536 X CORONAE BOREALIS—						
	4732.7	13.5	Pt	4769.5	[13.2	Ie
	4755.6	13.5	Pt	4777.5	13.4	Cu
	4761.6	13.5	B			

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
154615 R SERPENTIS—						
	4522.3	7.5	Kk	4570.3	6.9	Kk
	4526.3	7.5	Kk	4578.2	7.2	Kk
	4533.4	7.3	Kk	4582.1	7.2	Kk
	4535.3	7.3	Kk	4583.1	7.2	Kk
	4537.3	7.2	Kk	4586.1	7.4	Kk
	4538.3	7.1	Kk	4610.0	8.4	Kk
	4540.4	7.3	Kk	4613.1	8.3	Kk
	4542.4	7.2	Kk	4729.2	[11.6	Ch
	4545.3	7.0	Kk	4732.7	13.4	Pt
	4547.4	7.2	Kk	4755.6	13.6	Pt
	4554.3	6.9	Kk	4771.6	13.3	B
	4560.3	7.1	Kk			
154639 V CORONAE BOREALIS—						
	4732.7	6.8	Pt	4755.6	6.6	Pt
	4761.6	7.1	B	4772.5	7.0	Ya
154715 R LIBRAE—						
	4732.7	11.9	Pt			
155018 RR LIBRAE—						
	4730.4	12.2	An	4743.3	13.3	L
	4730.4	12.4	L	4754.3	13.8	L
	4732.7	13.0	Pt	4755.6	12.7	Pt
	4733.1	12.0	Ch			
155229 Z CORONAE BOREALIS—						
	4771.5	12.4	B			
155823 RZ SCORPII—						
	4699.2	10.1	En	4714.2	9.3	Sm
	4704.2	9.7	Sm	4720.2	9.3	Ht
	4706.2	9.7	En	4724.2	9.3	Ht
	4708.4	9.9	Ht	4726.3	9.3	En
	4709.2	9.3	Sm	4732.7	9.4	Pt
	4713.2	9.5	Ht	4755.6	9 5	Pt
	4713.2	9.5	En			
160021 Z SCORPII—						
	4697.9	11.8	Bl	4714.2	10.9	Sm
	4701.2	11.6	En	4724.3	10.8	Ht
	4704.2	11.2	Sm	4726.0	10.7	Bl
	4708.0	11.1	Bl	4726.3	10 5	En
	4709.2	11.0	Sm	4730.4	10.9	L
	4713.2	11.1	Ht	4752.3	10.5	L
160118 R HERCULIS—						
	4728.2	11.3	Ch	4757.6	8.8	Pc
	4732.7	11.1	Pt	4764.6	9.0	B
	4736.6	9.8	Jo	4769.6	8.8	Ie
	4738.2	9.8	Ch	4772.6	8.8	Ya
	4755.6	9.0	Pt			
160210 U SERPENTIS—						
	4731.7	8.9	Pc	4755.6	9.7	Pt
	4732.7	9.0	Pt	4758.6	9.4	Pc
	4736.7	8.8	Cy	4767.6	10.0	Ie
	4743.6	9.0	Jn	4770.5	10.2	Ya
160221a X SCORPII—						
	4708.0	10.6	Bl	4726.0	10.8	Bl
160325 SX HERCULIS—						
	4729.7	9.5	Pt	4755.6	7.9	Pt
	4732.6	9.2	Pt	4756.6	7.9	Pt
	4736.6	8.4	Pt	4758.6	7.7	Pt
	4737.3	8.6	L	4766.6	7 7	Pt
	4737.6	8.2	Pt	4769.6	7.8	Pt
	4738.6	8.0	Pt	4772.6	7.9	Pt
	4746.7	8.2	Pt	4773.5	8.0	Cu
	4747.6	8.1	Pt	4775.6	7.9	Pt
160325 SX HERCULIS—Continued.						
	4750.3	7.9	L	4776.6	7.8	Pt
	4753.6	8.0	Pt	4777.6	7.8	Pt
160519 W SCORPII—						
	4697.9	[12.5	Bl			
160625 RU HERCULIS—						
	4582.2	10.9	Kk	4736.7	[12.3	Cy
	4583.2	10.9	Kk	4743.5	13.6	L
	4728.4	14.1	L	4754.3	14.2	L
	4729.2	[11.5	Ch	4755.6	14.0	Pt
	4732.7	13.8	Pt	4764.6	[13.6	B
161122a R SCORPII—						
	4697.9	[13.0	Bl	4713.2	[12.2	En
	4699.2	[12.2	En	4724.2	[12.2	Ht
	4704.2	[12.2	Sm	4724.3	[12.2	En
	4707.2	[12.2	En	4732.7	13 2	Pt
	4709.2	[12.2	Sm	4755.7	12.2	Pt
	4713.2	[12.2	Ht			
161122b S SCORPII—						
	4697.9	12.8	Bl	4713.2	11.5	En
	4699.2	[12.6	En	4714.2	11.5	Sm
	4702.3	12.6	En	4724.2	11.0	Ht
	4704.2	12.2	Sm	4724.3	11.0	En
	4707.2	12.3	En	4726.0	11.1	Bl
	4708.0	12.0	Bl	4732.7	11.0	Pt
	4709.2	11.9	Sm	4755.7	11.6	Pt
	4713.2	12.2	Ht			
161138 W CORONAE BOREALIS—						
	4613.2	10.3	Kk	4755.7	12.4	Pt
	4732.7	12.5	Pt	4761.6	12.5	B
161607 W OPHIUCHI—						
	4750.3	11.1	L	4770.5	9.9	Ie
	4755.7	11.0	Pt			
162112 V OPHIUCHI—						
	4697.7	11.0	Pt	4755.7	7.9	Pt
	4732.7	9.1	Pt	4771.5	8.0	B
162119 U HERCULIS—						
	4729.2	7.4	Ch	4757.6	8.8	Pc
	4732.7	7.4	Pt	4758.6	8.4	Jo
	4733.4	7.8	Kl	4762.3	8.9	Kl
	4736.6	7.6	Jo	4764.6	8.6	B
	4737.4	7.6	Kl	4769.6	8 8	Cm
	4740.4	7.8	Kl	4769.6	8.7	Ie
	4743.6	7.9	Jo	4769.6	8.4	Jo
	4753.4	8.2	Kl	4772.6	8.9	Ya
	4755.7	7.8	Pt	4783.6	9.1	Cm
	4757.3	8.1	Kl			
162319 Y SCORPII—						
	4754.3	12.2	L			
162807 SS HERCULIS—						
	4732.7	9.2	Pt	4755.7	11.7	Pt
	4736.6	9.0	Jo	4763.6	12.3	B
	4737.4	9.0	L	4769.6	13.0	Ie
	4752.3	10.7	L			
162815 T OPHIUCHI—						
	4697.9	12.0	Bl	4758.3	[13.1	L
	4737.4	13.6	L			
162816 S OPHIUCHI—						
	4708.0	12.5	Bl	4737.4	9.9	L
	4708.9	12.3	Bl	4752.3	9.6	L
	4726.0	10.5	Bl			

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
163137 W HERCULIS—						
	4729.2	[11.2	Ch	4761.6	13.2	B
	4732.7	13.5	Pt	4769.6	13.1	Ie
	4755.7	13.6	Pt			
163172 R URSAE MINORIS—						
	4764.5	9.8	B	4765.5	10.3	Lp
163266 R DRACONIS—						
	4730.2	[10.8	Ch	4765.5	11.1	Lp
	4732.7	11.8	Pt	4771.6	11.2	L
	4755.7	11.6	Pt	4772.5	10.8	Ya
	4759.6	11.4	Pc			
164319 RR OPHIUCHI—						
	4700.3	11.2	En	4730.4	8.6	L
	4704.2	11.2	Sm	4730.4	8.6	Be
	4706.2	11.0	En	4732.7	8.2	Pt
	4709.2	11.0	Sm	4750.3	8.5	L
	4713.2	10.6	En	4755.7	8.5	Pt
	4714.2	10.2	Sm	4766.6	9.2	Pc
	4726.3	9.2	En	4772.5	9.3	Ya
164715 S HERCULIS—						
	4729.2	10.8	Ch	4761.6	11.9	B
	4732.7	11.6	Pt	4769.6	12.3	Ie
	4755.7	11.7	Pt	4772.6	12.0	Ya
164844 RS SCORPII—						
	4701.2	12.2	En	4713.2	[12.0	Ht
	4704.2	[11.7	Sm	4713.2	[12.0	En
	4706.2	12.3	En	4724.3	[12.0	Ht
	4708.4	12.0	Ht	4724.3	[12.0	En
	4708.9	11.6	Bl	4726.0	11.9	Bl
	4709.2	12.2	Sm			
165030 RR SCORPII—						
	4698.0	8.7	Bl	4726.0	7.6	Bl
	4708.9	8.3	Bl			
165202 SS OPHIUCHI—						
	4732.7	9.3	Pt	4755.7	12.0	Pt
165631 RV HERCULIS—						
	4756.6	[14.0	Bi	4771.6	13.8	B
165636 RT SCORPII—						
	4698.0	[13.0	Bl			
172215 R OPHIUCHI—						
	4763.6	13.1	B			
170627 RT HERCULIS—						
	4736.6	[11.6	Pw	4771.6	12.9	B
170833 RW SCORPII—						
	4698.0	10.0	Bl	4726.0	9.6	Bl
	4708.9	9.6	Bl			
171401 Z OPHIUCHI—						
	4732.7	12.7	Pt	4755.7	12.5	Pt
	4735.6	11.4	Pc	4769.6	12.0	B
171723 RS HERCULIS—						
	4732.7	8.7	Pt	4755.7	8.9	Pt
	4736.6	8.3	Pw	4761.7	9.3	B
	4736.6	8.1	Jo	4769.6	9.8	Jo
172486 S OCTANTIS—						
	4708.3	9.0	Sm	4713.4	9.1	Sm
	4708.3	9.1	Ht	4720.2	10.0	Ht
	4709.0	8.4	Bl	4724.2	10.2	Ht
	4713.3	9.4	Ht	4726.0	9.7	Bl
172809 RU OPHIUCHI—						
	4732.7	12.6	Pt	4771.6	13.3	B
	4755.7	13.2	Pt			
173543 RU SCORPII—						
	4709.0	11.2	Bl	4726.0	11.5	Bl
174135 SV SCORPII—						
	4698.0	10.6	Bl	4726.0	9.8	Bl
	4708.9	10.3	Bl			
174162 W PAVONIS—						
	4700.3	[12.1	En	4713.2	[12.3	Ht
	4701.1	[13.0	Bl	4713.3	[12.1	En
	4704.3	[12.0	Sm	4724.2	[12.3	Sm
	4706.3	[12.1	En	4724.2	12.5	Ht
	4708.3	[12.3	Ht	4724.3	[12.1	En
	4709.2	[13.0	Sm			
174406 RS OPHIUCHI—						
	4732.7	11.0	Pt	4755.7	11.1	Pt
174551 U ARAE—						
	4700.3	11.0	En	4711.2	10.8	En
	4704.2	11.9	Sm	4714.2	11.2	Sm
	4707.2	11.0	En	4728.3	8.6	En
	4709.2	11.5	Sm			
175111 RT OPHIUCHI—						
	4736.6	10.1	Pt	4771.6	10.3	B
	4755.7	10.3	Pt			
175519 RY HERCULIS—						
	4756.6	13.7	Bi	4761.6	13.1	B
	4756.7	13.7	Pt	4769.6	13.6	Ie
175654 V DRACONIS—						
	4732.6	10.6	Pt	4770.6	13.1	Ie
	4756.7	11.8	Pt			
180363 R PAVONIS—						
	4700.3	11.4	En	4713.3	11.3	En
	4704.3	11.3	Sm	4720.2	10.8	Ht
	4706.3	11.4	En	4724.2	10.1	Ht
	4708.3	11.6	Ht	4724.2	10.3	En
	4709.2	11.0	Sm	4724.2	10.4	Sm
	4713.2	11.6	Ht			
180531 T HERCULIS—						
	4732.6	10.7	Pt	4756.7	11.0	Pt
	4736.7	9.8	Jo	4757.6	10.4	Pc
	4737.3	10.3	L	4758.3	11.4	L
	4742.8	11.0	Gb	4765.4	11.5	Lp
	4746.6	10.6	L	4769.6	11.5	Ie
180565 W DRACONIS—						
	4732.6	12.4	Pt	4762.6	11.	Ie
	4756.6	11.4	Bi	4771.6	10.4	B
	4756.7	11.8	Pt	4772.7	11.2	Cu
180666 X DRACONIS—						
	4756.6	14.0	Bi			
180911 NOVA OPHIUCHI—						
	4756.7	[13.0	Pt			
181103 RY OPHIUCHI—						
	4732.6	8.9	Pt	4758.7	8.4	Pt
	4740.7	9.3	Bi	4769.6	9.2	B
	4756.6	8.5	Bi	4770.6	9.3	Jo
	4758.6	8.7	Jo	4772.6	9.5	Jo
181136 W LYRAE—						
	4732.6	10.5	Pt	4758.3	9.1	L
	4738.6	10.0	L	4758.7	8.9	Pt
	4742.8	10.0	Gb	4765.7	8.5	Gb
	4746.6	9.5	L	4767.7	8.5	B
	4757.7	8.8	Jo	4769.7	8.5	Jo
182133 RV SAGITTARII—						
	4798.0	[13.6	Bl			

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
182224 SV HERCULIS—						
	4746.6	[13.0	L	4769.6	[14.0	B
182306 T SERPENTIS—						
	4758.7	11.8	Pt	4769.6	12.1	B
183308 X OPHIUCHI—						
	4732.6	8.1	Pt	4743.6	8.1	Jo
	4734.7	8.0	Wb	4752.3	7.4	L
	4736.7	7.9	Jo	4754.7	7.8	Wb
	4736.7	8.0	Cy	4757.7	7.6	Jo
	4737.3	7.6	Be	4758.7	7.8	Pt
	4737.3	7.9	L	4769.6	7.5	B
	4741.7	8.6	Cy	4770.6	7.8	Jo
184134 RV LYRAE—						
	4769.6	11.5	Pw	4774.6	10.7	Pw
	4772.7	11.3	Cu			
184205 R SCUTI—						
	4644.3	5.5	Kd	4753.6	6.5	Pt
	4652.3	5.7	Kd	4754.4	6.7	Be
	4671.0	5.4	Kd	4754.4	6.7	L
	4674.3	5.5	Kd	4754.6	7.0	Ie
	4682.2	5.5	Kd	4754.7	6.8	Pt
	4684.0	5.2	Kd	4755.6	6.6	Pc
	4700.0	5.4	Kd	4755.7	6.6	Pt
	4703.0	5.4	Kd	4756.4	6.4	An
	4707.0	5.6	Kd	4756.6	6.5	Pt
	4709.0	5.8	Kd	4756.6	7.0	Cm
	4710.0	5.7	Kd	4757.6	6.1	Pc
	4711.0	5.8	Kd	4757.7	6.3	Jo
	4727.0	6.5	Kd	4758.5	6.6	Ie
	4729.1	7.0	Ch	4758.6	6.5	Pt
	4729.7	6.5	Pt	4758.6	6.1	Pc
	4730.4	6.5	Be	4758.7	6.2	Sg
	4730.5	6.0	Pw	4759.4	6.1	L
	4730.6	6.5	Pt	4759.6	6.1	Pc
	4730.6	6.9	Ie	4760.6	6.0	Gb
	4731.6	7.0	Cy	4761.3	6.1	Ro
	4731.6	6.8	Pc	4762.5	6.0	Ie
	4731.6	6.0	Pc	4765.6	5.7	Pc
	4731.7	6 5	Gb	4765.6	6.2	Pt
	4732.6	6.5	Pt	4765.7	6.0	Gb
	4732.6	6.8	Cy	4766.6	5.7	Pc
	4733.4	5.8	Kl	4766.6	6.1	Pt
	4733.6	7.0	Pc	4767.5	5.8	Ie
	4733.6	6.0	Pc	4767.6	5 6	Pc
	4734.6	6.0	Pc	4768.6	5.5	Pc
	4734.6	6.9	Pc	4769.6	5.5	Pc
	4735.6	6.9	Gb	4769.6	6.0	Pt
	4735.6	6.9	Pc	4769.6	5.7	Cm
	4736.6	6 9	Pc	4770.6	5.3	Ya
	4736.6	7.2	Ie	4770.7	6.0	Jo
	4736.6	6.7	Pt	4771.6	5.7	O
	4736.7	7.0	Jo	4771.6	5.4	Pc
	4736.7	6.9	Cy	4772.5	5.6	Ie
	4737.2	7.1	Ch	4772.6	5 4	Pc
	4737.3	6.9	Be	4772.6	5.0	Jo
	4738.4	6.9	An	4772.6	5.5	Pt
	4738.6	6.8	Pt	4775.2	5.7	Ro
	4738.7	7.0	Cy	4775.6	5.4	Pc
	4741.5	6.9	L	4775.6	5.5	Pt
	4741.6	7.0	Cy	4776.6	5.3	Pt
	4742.6	6.9	Pc	4776.6	5.3	Pc
	4743.5	6.9	L	4777.6	5.1	Cu
184205 R SCUTI—Continued.						
	4743.7	7.1	Jo	4777.6	6.3	Pt
	4749.7	6.9	Pt	4783.6	5.2	Cm
	4753.3	6.9	Be			
184243 RW LYRAE—						
	4767.7	[14.0	B			
184300 NOVA AQUILAE—						
	4736.6	11.2	Pt	4759.6	10.4	Pc
	4736.7	10.6	Pc	4761.3	11.0	Ro
	4753.6	11.2	Pt	4765.6	11.0	Pt
	4755.7	10.9	Pt	4766.3	11.0	Ro
	4758.5	10.7	Ie	4769.6	11.0	Pt
	4758.6	11.1	Pt	4772.6	11.0	Pt
185032 RX LYRAE—						
	4758.6	15.0	Pt			
185437a S CORONAE AUSTRALIS—						
	4698.0	11.5	Bl	4726.0	11.5	Bl
	4709.0	12.5	Bl			
185512a ST SAGITTARII—						
	4743.5	12.9	L	4758.3	13.7	L
185537a R CORONAE AUSTRALIS—						
	4698.0	12.7	Bl	4726.0	11.3	Bl
	4709.0	12.5	Bl			
185537b T CORONAE AUSTRALIS—						
	4698.0	[13.0	Bl			
185634 Z LYRAE—						
	4732.6	10.9	Pt	4767.7	10.2	B
	4758.6	10.4	Pt			
190108 R AQUILAE—						
	4732.6	8.7	Pt	4765.4	6.7	Lp
	4758.7	7.5	Pt	4771.7	6.7	B
190529a V LYRAE—						
	4732.6	12.3	Pt	4758.6	12.6	Pt
	4736.7	12.0	Ie			
100818 RX SAGITTARII—						
	4729.1	10.9	Ch	4758.6	10.5	Pt
	4732.6	11.1	Pt			
190819a RW SAGITTARII—						
	4729.1	9.7	Ch	4758.6	9.0	Pt
	4732.6	8.8	Pt			
190907 TY AQUILAE—						
	4758.6	10.3	Pt			
190925 S LYRAE—						
	4756.6	[14.0	Bi			
190926 X LYRAE—						
	4736.6	9.0	Pt	4758.6	9.0	Pt
190933a RS LYRAE—						
	4756.6	[14.0	Bi			
190941 RU LYRAE—						
	4762.6	13.3	Ie			
190967 U DRACONIS—						
	4730.2	[10.9	Ch	4758.6	12.5	Pt
	4738.1	12.2	Ch			
191007 W AQUILAE—						
	4773.6	12.7	Cu			
191017 T SAGITTARII—						
	4729.1	10.8	Ch	4758.6	8.8	Pt
	4736.6	10.2	Pt			
191019 R SAGITTARII—						
	4729.1	11.4	Ch	4758.6	10.2	Pt
	4736.6	11.2	Pt			

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
191033 RY SAGITTARII—						
	4699.2	6.9	Ht	4738.6	6.5	Pt
	4701.3	7.0	En	4753.3	6.5	Be
	4704.2	6.8	Sm	4753.3	6.4	L
	4707.2	6.8	En	4753.6	6.1	Pt
	4708.3	6.5	Ht	4755.7	6.5	Pt
	4708.3	6.8	Sm	4756.6	6.5	Pt
	4709.0	6.0	Bl	4758.6	6.6	Pt
	4713.3	6.5	Ht	4759.4	6.7	L
	4713.3	6.6	En	4759.6	6.6	Pc
	4714.3	6.8	Sm	4759.6	6.5	Pw
	4724.3	6.8	Sm	4765.6	6.6	Pt
	4724.3	6.5	Ht	4766.6	6.6	Pt
	4724.3	6.9	En	4766.6	6.9	Pc
	4726.0	6.9	Bl	4768.6	7.1	Pc
	4729.1	6.8	Ch	4769.6	7.1	Pc
	4729.7	6.5	Pt	4769.6	6.7	Pt
	4732.6	6.7	Pt	4771.6	6.8	Pc
	4736.6	6.5	Pt	4772.6	6.8	Pc
	4736.7	6.5	Pc	4772.6	6.6	Pt
	4737.4	6.5	Be	4776.6	6.5	Pt
	4737.4	6.5	L	4777.6	6.5	Pt
	4737.6	6.6	Pt			
191124 TY SAGITTARII—						
	4701.0	[12.4	Bl			
191319a S SAGITTARII—						
	4701.0	[12.9	Bl	4758.6	11.8	Pt
	4758.6	11.5	Pc			
191331 SW SAGITTARII—						
	4701.1	11.2	Bl	4726.0	10.6	Bl
	4709.0	11.3	Bl			
191350 TZ CYGNI—						
	4758.6	10.7	Pt			
191637 U LYRAE—						
	4758.6	9.0	Pt			
192928 TY CYGNI—						
	4725.1	10.5	Ch	4758.6	9.7	Pt
	4735.1	10.3	Ch			
193311 RT AQUILAE—						
	4728.1	[10.4	Ch	4771.7	13.8	B
193449 R CYGNI—						
	4730.6	[12.8	Ie	4756.6	13.6	Pt
	4733.1	[11.0	Ch	4762.2	[12.4	Gs
	4743.6	[11.	Jn	4772.6	13.5	Ie
193509 RV AQUILAE—						
	4756.6	12.4	Pt	4759.6	12.4	Ie
193972 T PAVONIS—						
	4701.1	12.9	Bl	4713.2	11.9	Ht
	4704.3	12.1	Sm	4724.2	11.5	Sm
	4708.3	12.1	Ht	4724.2	11.0	Ht
	4709.0	11.8	Bl	4726.0	10.7	Bl
	4709.2	12.0	Sm			
194048 RT CYGNI—						
	4733.1	[11.1	Ch	4766.8	9.0	Sg
	4744.1	[11.1	Ch	4769.6	9.4	Pc
	4756.6	9.8	Pt	4769.8	9.1	Wb
	4757.8	9.9	Jo	4769.8	9.3	Jo
194348 TU CYGNI—						
	4582.2	10.3	Kk	4714.1	[12.1	Kk
	4583.2	10.3	Kk	4733.1	[11.2	Ch
	4586.3	9.8	Kk	4744.1	[10.9	Ch
194348 TU CYGNI—Continued.						
	4613.2	10.9	Kk	4756.6	11.2	Pt
	4704.0	[12.4	Kk			
194604 X AQUILAE—						
	4756.6	13.9	Bi	4771.7	13.4	B
194632 χ CYGNI—						
	4644.1	8.2	Kd	4756.6	12.8	Pt
	4728.1	[10.5	Ch	4765.5	[13.0	Lp
	4741.6	12.4	L	4773.7	12.9	Cu
	4753.3	12.8	L			
194929 RR SAGITTARII—						
	4701.0	8.8	Bl	4726.0	5.8	Bl
	4709.0	7.8	Bl			
195142 RU SAGITTARII—						
	4700.3	10.5	En	4711.2	11.6	En
	4701.0	10.3	Bl	4713.3	11.6	Ht
	4704.2	10.5	Sm	4714.2	11.0	Sm
	4707.2	10.9	En	4724.3	11.8	Sm
	4708.3	11.3	Ht	4724.3	11.8	Ht
	4709.0	11.1	Bl	4724.3	12.0	En
	4709.2	10.5	Sm	4726.0	12.2	Bl
195202 RR AQUILAE—						
	4756.6	10.1	Pt			
195553 NOVA CYGNI—						
	4732.6	[12.2	Pt	4758.6	13.4	Ie
	4737.6	[12.2	Pt	4765.6	12.8	Pt
	4755.6	12.8	Pt			
195849 Z CYGNI—						
	4756.6	8.6	Pt	4772.5	8.9	Ie
195855 S TELESCOPII—						
	4701.1	12.8	Bl			
200212 SY AQUILAE—						
	4738.6	14.0	L	4758.4	14.0	L
	4756.6	13.5	Pt			
200357 S CYGNI—						
	4730.6	10.3	Pw	4758.6	11.0	Pc
	4731.7	10.8	Sg	4758.7	10.5	Sg
	4756.6	10.5	Ie	4765.5	11.5	Lp
	4756.6	11.0	Pt			
200514 R CAPRICORNI—						
	4729.1	[11.4	Ch	4756.6	13.0	Pt
	4756.6	13.1	Bi	4768.6	12.9	B
200715a S AQUILAE—						
	4746.6	10.3	Cl	4758.6	9.9	Pt
	4758.6	9.5	Cl	4765.4	9.4	Lp
200715b RW AQUILAE—						
	4746.6	9.4	Cl	4758.6	9.5	Cl
	4756.6	9.3	Pt			
200747 R TELESCOPII—						
	4701.1	11.1	Bl	4709.0	10.9	Bl
200812 RU AQUILAE—						
	4730.6	[11.2	Pw	4756.6	13.7	Bi
200822 W CAPRICORNI—						
	4701.1	12.1	Bl	4709.0	11.5	Bl
200906 Z AQUILAE—						
	4759.6	12.0	Ie	4765.6	12.2	Pt
200938 RS CYGNI—						
	4613.2	7.7	Kk	4736.8	6.8	Cy
	4783.0	8.2	Kk	4738.6	6.8	L
	4699.0	7.5	Kk	4741.6	7.2	Cy
	4703.9	7.5	Kk	4744.1	7.2	Ch
	4714.1	7.8	Kk	4746.6	7.1	L

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
200938 RS CYGNI—Continued.						
	4723.1	7.2	Ch	4756.4	6.9	An
	4725.1	7.3	Ch	4756.4	7.2	L
	4728.1	7.3	Ch	4757.7	7.0	Wb
	4731.6	6.8	Cy	4757.8	7.0	Jo
	4735.1	7.2	Ch	4765.6	7.4	Pt
	4735.9	6.7	Wb	4766.8	7.0	Sg
	4736.8	7.0	Jo	4769.8	7.2	Jo
201008 R DELPHINI—						
	4741.6	11.1	L	4767.5	12.0	Ie
	4753.3	11.6	L	4773.7	12.3	Cu
	4765.6	11.6	Pt			
201121 RT CAPRICORNI—						
	4765.6	6.9	Pt			
201130 SX CYGNI—						
	4736.8	11.2	Cy	4765.6	8.8	Pt
	4756.6	9.3	Ie			
201139 RT SAGITTARII—						
	4701.1	8.0	Bl	4709.0	8.2	Bl
201437b WX CYGNI—						
	4723.1	[11.7	Ch	4765.6	11.4	Pt
	4731.6	12.0	Cy	4766.8	10.7	Sg
	4736.8	12.3	Cy	4772.5	11.4	Ie
	4741.6	11.8	Cy			
201647 U CYGNI—						
	4736.8	9.5	Jo	4765.6	10.0	Pt
	4757.8	9.6	Jo	4766.8	9.9	Sg
	4761.5	11.0	Ro	4769.8	9.5	Jo
202240 U MICROSCOPII—						
	4709.0	[13.0	Bl			
202622 RU CAPRICORNI—						
	4768.7	12.7	B			
202817 Z DELPHINI—						
	4732.6	[10.4	Pw	4765.6	13.3	Pt
202946 SZ CYGNI—						
	4729.7	9.5	Pt	4755.7	9.0	Pt
	4730.6	9.5	Pt	4756.6	9.2	Pt
	4732.6	9.6	Pt	4758.6	9.3	Pt
	4736.6	9.0	Pt	4765.6	9.1	Pt
	4737.6	8.9	Pt	4766.6	8.9	Pt
	4738.6	8 8	Pt	4768.8	8.8	Pt
	4742.8	9.4	Pt	4769.6	8.9	Pt
	4745.6	9.6	Pt	4770.6	8.9	Pt
	4746.7	9.6	Pt	4772.6	8.9	Pt
	4747.6	9.5	Pt	4773.7	9.2	Pt
	4749.7	9.4	Pt	4775.6	9.7	Pt
	4752.8	8.7	Pt	4776.6	9.6	Pt
	4753.6	9.0	Pt	4777.6	9.6	Pt
	4754.7	8.9	Pt			
202954 ST CYGNI—						
	4765.6	10.6	Pt	4772.5	11.0	Ie
203226 V VULPECULAE—						
	4765.6	8.6	Pt			
203429 R MICROSCOPII—						
	4709.0	11.0	Bl			
203611 Y DELPHINI—						
	4769.6	[13.0	Cl			
203816 S DELPHINI—						
	4765.6	9.6	Pt			
203847 V CYGNI—						
	4586.4	8.6	Kk	4737.1	11.0	Ch
	4613.2	8.6	Kk	4758.6	11.8	Pc
	4723.1	10.5	Ch	4765.6	11.8	Pt
203905 Y AQUARII—						
	4729.1	[11.9	Ch	4765.6	11.5	Pt
	4756.6	12.0	Ie	4766.6	11.4	Pc
	4757.6	12.1	Pc			
204016 T DELPHINI—						
	4731.7	9.9	Pw	4758.7	11.1	Sg
	4736.7	11.1	Cy	4765.6	11.6	Pt
	4746.6	10.7	Cl	4767.5	11.8	Ie
	4758.6	10.8	Cl			
204102 V AQUARII—						
	4765.6	8.1	Pt			
204104 W AQUARII—						
	4738.6	12.0	L	4758.3	12.1	L
	4746.6	11.8	L			
204215 U CAPRICORNI—						
	4709.0	[12.2	Bl	4768.7	13.1	B
204405 T AQUARII—						
	4729.1	11.3	Ch	4770.6	8.3	Jo
	4765.7	8.5	Pt	4772.6	7.9	Jo
204846 RZ CYGNI—						
	4765.7	13.0	Pt	4773.7	12.6	Cu
204954 S INDI—						
	4709.0	12.5	Bl			
205017 X DELPHINI—						
	4765.7	13.6	Pt			
205923 R VULPECULAE—						
	4729.2	11.0	Ch	4765.7	12.7	Pt
	4756.6	13.2	Ie	4773.7	12.0	Cu
210129 TW CYGNI—						
	4730.6	12.4	Ie	4767.5	11.6	Ie
210221 X CAPRICORNI—						
	4770.6	12.6	Cu			
210504 RS AQUARII—						
	4738.6	11.2	L	4758.6	11.1	Ie
	4746.6	10.9	L	4765.7	10.6	Pt
	4758.3	10.8	L	4769.6	10.8	Pc
210516 Z CAPRICORNI—						
	4765.7	9.5	Pt	4768.7	9.4	B
210812 R EQUULEI—						
	4762.6	11.8	Cl	4767.6	12.1	Cl
	4765.7	12.1	Pt			
210868 T CEPHEI—						
	4582.1	9.9	Kk	4714.0	6.7	Kk
	4583.0	9.9	Kk	4723.1	6.3	Ch
	4584.0	9.9	Kk	4731.1	6.3	Ch
	4586.0	10.0	Kk	4736.8	5.7	Jo
	4587.0	10.1	Kk	4737.2	6.4	Ch
	4613.2	8.4	Kk	4741.6	5.8	L
	4651.0	8.2	Kk	4752.3	5.7	L
	4699.0	7.1	Kk	4755.7	5.5	Wb
	4704.0	6.8	Kk	4757.7	5.4	Jo
	4705.1	6.8	Kk	4765.7	6.0	Pt
	4708.1	7.0	Kk	4769.9	5.9	Wb
	4712.1	6.7	Kk	4770.6	6.5	Cm
	4713.1	6.7	Kk			
210903 RR AQUARII—						
	4737.6	10.4	Pt	4765.7	9.8	Pt
	4758.6	9.7	Ie			

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
211614 X PEGASI—						
	4737.6	10.8	Pt	4762.6	10.0	Ie
	4756.7	9.9	Pw	4765.7	9.8	Pt
	4759.6	9.6	Pw	4770.6	9.2	Pw
211615 T CAPRICORNI—						
	4729.2	10.4	Ch			
212030 S MICROSCOPII—						
	4700.4	[12.4	Sm	4708.3	[12.4	Sm
212814 Y CAPRICORNI—						
	4737.6	13.5	Pt	4768.7	[13.5	B
213244 W CYGNI—						
	4645.2	6.3	Kd	4684.0	6.0	Kd
	4652.3	6.2	Kd	4700.0	6.0	Kd
	4671.1	6.0	Kd	4703.0	6.0	Kd
	4674.3	6.1	Kd	4710.0	6.1	Kd
	4682.2	6.2	Kd	4727.0	6.1	Kd
213678 S CEPHEI—						
	4765.5	8.3	Lp	4765.7	8.5	Pt
213753 RU CYGNI—						
	4731.6	8.9	Cy	4738.1	8.8	Ch
	4737.6	8.6	Pt	4765.7	8.3	Pt
213843 SS CYGNI—						
	4723.1	11.3	Ch	4756.5	11.8	Ie
	4729.1	11.8	Ch	4756.6	11.6	Pt
	4729.7	11.8	Pt	4756.7	11.1	Pw
	4730.2	11.7	Ch	4757.3	9.7	L
	4730.6	11.7	Ie	4757.3	10.2	Kl
	4730.6	11.8	Pt	4757.6	10.2	Pc
	4731.2	11.7	Ch	4757.7	9.8	Pc
	4731.6	11.6	Pc	4758.3	9.8	Kl
	4731.7	11.9	Pw	4758.4	9.7	L
	4732.2	11.7	Ch	4758.6	9.6	Pc
	4733.1	11.8	Ch	4758.6	9.9	Pt
	4733.6	11.7	Pc	4758.6	9.5	Cl
	4734.6	11.5	Pc	4758.6	9.3	Ie
	4735.1	11.8	Ch	4758.7	9.5	Sg
	4735.6	11.5	Pt	4759.3	9.5	L
	4736.6	11.5	Pc	4759.5	9.5	Pw
	4736.6	11.7	Cy	4759.6	9.1	Pc
	4736.6	11.8	Pt	4759.6	9.4	Cl
	4736.6	11.8	Pw	4759.6	9.2	Ie
	4736.6	11.9	Ie	4760.3	8.9	Kl
	4737.1	11.8	Ch	4761.6	9.0	Pc
	4737.4	11.5	L	4761.6	8.9	Ro
	4737.4	11.8	Kl	4762.3	8.6	Kl
	4737.6	11.8	Pt	4762.5	8.5	Ie
	4738.6	11.9	L	4762.5	8.5	Ro
	4738.6	11.8	Pt	4762.6	8.8	Cl
	4738.7	11.5	Cy	4765.6	8.9	Pc
	4740.4	11.3	Kl	4766.5	8.9	Ro
	4740.6	11.8	Cy	4766.6	9.0	Pc
	4740.8	11.8	Bi	4766.8	9.0	Sg
	4741.6	11.9	L	4767.5	9.1	Ie
	4741.8	11.8	Bi	4767.5	9.6	Cl
	4742.6	11.5	Pc	4767.6	9.0	Pc
	4742.8	11.8	Pt	4768.6	9.1	Pc
	4744.7	11.6	Cy	4769.6	9.7	Pc
	4745.6	11.7	Pt	4769.6	9.5	Cl
	4746.6	11.6	L	4769.6	9.7	Ie
	4746.6	11.8	Cl	4769.6	9.9	Cm
	4746.7	11.8	Pt	4770.5	9.8	Ya
	4747.4	11.4	Kl	4770.5	10.1	Ie
213843 SS CYGNI—Continued.						
	4747.8	11.8	Pt	4770.6	9.8	Pw
	4749.7	11.8	Pt	4771.6	9.9	Pc
	4750.3	11.4	L	4772.5	10.6	Ie
	4752.3	11.4	L	4772.6	10.1	Pc
	4752.8	11.8	Pt	4772.6	10.5	Ya
	4753.3	11.4	L	4773.5	10.7	Ie
	4753.6	11.8	Pt	4773.6	10.9	Bx
	4754.4	11.3	L	4774.6	10.9	Pw
	4754.4	11.2	Be	4774.6	11.6	Cu
	4754.7	11.6	Pt	4775.6	11.8	Ro
	4754.7	11.6	Ie	4775.5	11.6	Ie
	4755.6	11.5	Pt	4775.7	11.0	Pw
	4755.6	11.8	Pt	4776.6	11.2	Pc
	4756.4	11.0	An			
213937 RV CYGNI—						
	4737.7	6.7	Pt	4765.7	6.7	Pt
214024 RR PEGASI—						
	4738.6	9 8	Pt	4767.5	11.8	Cl
	4765.7	11.5	Pt			
214247 R GRUIS—						
	4699.3	8.0	Ht	4712.3	7.2	En
	4699.3	7.1	En	4713.3	8.1	Ht
	4700.4	7.4	Sm	4713.3	8.0	Sm
	4706.3	6.6	En	4724.3	8.4	Sm
	4708.3	7.6	Sm	4724.3	8.5	Ht
	4709.3	8.0	Ht	4726.3	8.1	En
215605 V PEGASI—						
	4770.8	13.8	Cu			
215717 U AQUARII—						
	4738.6	12.2	Pt	4765.7	11.7	Pt
215934 RT PEGASI—						
	4729.9	12.8	Bi	4765.7	[11.3	Pt
	4738.6	10.9	Pt			
220133 RZ PEGASI—						
	4731.6	9.3	Pt	4765.7	9.9	Pt
220412 T PEGASI—						
	4732.3	[11.6	Ch			
220613 Y PEGASI—						
	4729.9	[13.6	Bi	4767.7	13.5	Cu
220714 RS PEGASI—						
	4729.9	[13.2	Bi			
221938 T GRUIS—						
	4700.4	10.1	Sm	4713.3	9.6	Sm
	4708.3	9.6	Sm	4724.3	9.0	Sm
221948 S GRUIS—						
	4699.3	[12 2	En	4712.3	[12.2	En
	4699.4	12.8	Ht	4713.3	[12.8	Sm
	4700.4	[12.2	Sm	4713.4	[12.8	Ht
	4706.3	[12.2	En	4724.3	[12.8	Sm
	4708.3	[12.8	Sm	4724.4	[12.2	Ht
	4708.4	[12.8	Ht	4726.3	12.2	En
222129 RV PEGASI—						
	4767.6	13.3	B			
222439 S LACERTAE—						
	4729.9	12.4	Bi	4767.6	13.3	B
	4738.6	13.0	Pt	4772.6	13.4	Ie
	4765.7	13.0	Pt			
223462 T TUCANAE—						
	4699.3	8.9	Ht	4713.3	9.9	Ht
	4700.4	9.6	Sm	4713.4	10.2	Sm

VARIABLE STAR OBSERVATIONS RECEIVED DURING SEPTEMBER, 1926—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
223462 T TUCANAE—Continued.						
	4708.3	9.6	Sm	4724.3	10.9	Sm
	4708.4	9.3	Ht	4724.3	10.6	Ht
223841 R LACERTAE—						
	4729.9	9.0	Bi	4738.6	8.8	Pt
	4732.2	8.9	Ch	4765.7	10.0	Pt
225914 RW PEGASI—						
	4758.6	[13.2	Ie	4766.6	13.7	B
230110 R PEGASI—						
	4730.2	10.6	Ch	4757.3	10.2	Kl
	4737.4	9.8	Kl	4760.3	10.3	Kl
	4738.6	11.0	Pt	4762.3	10.3	Kl
	4740.4	9.8	Kl	4762.6	11.1	Ie
	4747.4	9.9	Kl	4765.7	11.5	Pt
230759 V CASSIOPEIAE—						
	4704.1	8.3	Kk	4762.2	11.0	Gs
	4714.1	8.3	Kk	4762.3	11.5	Ro
	4732.2	9.5	Ch	4765.7	11.1	Pt
	4736.7	9.6	Cy	4766.6	11.0	B
	4738.6	10.0	Pt			
231425 W PEGASI—						
	4729.9	9.5	Bi	4747.4	9.6	Kl
	4732.2	10.0	Ch	4757.3	9.3	Kl
	4733.4	9.8	Kl	4760.3	9.3	Kl
	4737.4	10.0	Kl	4762.3	9.1	Kl
	4740.4	9.6	Kl	4770.6	8.2	Jo
231508 S PEGASI—						
	4730.2	10.0	Ch	4766.6	9.4	B
	4738.7	10.2	Pt	4774.6	9.5	Pw
	4765.7	9.4	Pt			
222746 V PHOENICIS—						
	4708.3	[12.0	Ht	4713.3	[12.0	Ht
232848 Z ANDROMEDAE—						
	4731.2	9.7	Ch	4765.7	9.5	Pt
	4738.7	9.5	Pt	4771.1	9.8	O
	4756.7	10.0	Pw			
233335 ST ANDROMEDAE—						
	4731.7	8.6	Pt	4767.6	8.4	B
	4738.7	8.6	Pt	4771.6	8.9	O
	4765.7	8.1	Pt			
233815 R AQUARII—						
	4714.1	9.7	Kk	4765.7	9.9	Pt
	4730.2	9.8	Ch			
233856 Z CASSIOPEIAE—						
	4766.6	[13.8	B	4741.6	[13.1	Cy
235053 RR CASSIOPEIAE—						
	4728.5	[13.1	Bn	4742.4	[13.1	Bn
	4734.4	13.3	Bn	4756.4	[13.1	Bn
235209 V CETI—						
	4738.6	10.4	L	4756.6	10.6	L
235350 R CASSIOPEIAE—						
	4731.3	7.2	Ch	4738.7	7.0	Cy
	4736.7	7.7	Jo	4743.6	8.2	Jo
235525 Z PEGASI—						
	4738.7	10.0	Pt	4765.7	9.3	Pt
	4762.6	9.8	Ie	4771.6	9.5	O
235855 Y CASSIOPEIAE—						
	4766.7	10.0	B			
235939 SV ANDROMEDAE—						
	4729.9	[13.0	Bi	4766.7	12.9	B

Total observations, 1923; stars observed, 332; total observers, 35.

The following observers have contributed to this report of observations received during the month of September, 1926: Ancarani, "An"; Baldwin, "Bl"; Barnes, "Bx"; Benini, "Be"; Berman, "Bi"; Bouton, "B"; Brown, "Bn"; Chandra, "Ch"; Chisolm, "Cm"; Cilley, "Cy"; Clement, "Cl"; Cunningham, "Cu"; Ensor, "En"; Gaebler, "Gb"; Glaze, "Gl"; Goodsell, "Gs"; Houghton, "Ht"; Iedema, "Ie"; Johnstone, "Jn"; Jones, "Jo"; Kanda, "Kd"; Kasai, "Kk"; Kohl, "Kl"; Lacchini, "L"; Leavenworth, "Lv"; Lepper, "Lp"; Olcott, "O"; Peltier, "Pt"; Proctor, "Pc"; Rhorer, "Ro"; Skaggs, "Sg"; Smith, "Sm"; Watson, "Pw"; Braid White, "Wb"; and Yalden, "Ya".

LEON CAMPBELL, Recording Secretary.

October 12, 1926.

COMET NOTES.

Comet Notes from the Yerkes Observatory.

COMET 1925 *b* (REID).—Still faintly visible as a small round nebulosity of a brightness nearing 16^{M}, this comet has now been under observation for more than eighteen months. It will soon become too faint for further measurement.

PERIODIC COMET 1926 *c* (KOPFF).—In September this comet reached 16^{M} but on October 15, when I last photographed it, the brightness had gone down to 16½^{M}. Observations are becoming difficult not only on account of the faintness of the comet but also on account of its lack of condensation. Its increasing

distance from both earth and sun makes further observations questionable.

PERIODIC COMET 1926 *d* (FINLAY).—A relatively easy object of 11M after its rediscovery in August, this comet has increased more rapidly in brightness than was expected from the distance relations. It was not brighter than 14M.5 on October 14 and was very hard to measure because it appears as a large diffuse nebulosity without nucleus.

PERIODIC COMET 1926 *e* (GIACOBINI-ZINNER).—In *Nature* of September 25, Mr. Cripps indicated December 7 of this year as the probable date of perihelion passage for this return. This lead to the discovery just announced by Schwassmann at Bergedorf (Germany), who found the object on October 16 as a 14M nebulosity in the following position:

Oct. 16.7431 U.T., $17^h\,34^m\,52^s$, $+2°\,32'$.

Cloudy weather has so far prevented observations here. It will be remembered that this comet, first discovered in 1900 by Giacobini at Nice (France), was found to have a period of 6½ years. The orbit is so situated that only alternate apparitions are favorable for observations; the intermediate returns occur when the comet is nearly in superior conjunction with the sun, so that there is little chance of seeing it then. Missed in 1907, it was picked up independently by Zinner in 1913 and followed that time for a couple of months. Not seen in 1920 it has now made a new appearance as expected. The position given by Schwassmann indicates December 11.8 for the time of perihelion; the prediction is therefore less than 5 days in error after an interval of 13 years.

The following approximate ephemeris is computed from the *British Astronomical Association Handbook* for 1926 by extrapolation from the two dates, December 3 and 11, given there for the time of perihelion:

1926	α	δ	Mag.
	h m	° ′	
Oct. 16.0	17 23	+ 2 44	14.0
Oct. 24	17 45	+ 0 35	
Nov. 1	18 10	— 1 39	
9	18 38	— 3 56	13.5
17	19 9	— 6 16	
Nov. 25	19 42	— 8 35	
Dec. 3	20 19	—10 48	13.1
11	20 58	—12 51	
19	21 39	—14 34	
Dec. 27	22 21	—15 48	13.0

The comet, situated now in the evening sky in Ophiuchus, will rapidly move eastward across the constellations of Serpens, Aquila, Capricornus, and Aquarius. A brilliant apparition is, however, not anticipated for the ephemeris shows an increase of only one magnitude up to December at which time the maximum brightness is expected. But the comet may become somewhat brighter than 13M because near perihelion the gain in luminosity is generally greater than is indicated by the law of inverse squares of the distances used in the ephemeris.

No further information has been received concerning Wilk's cometary object mentioned last month.

In the coming months COMET 1925 *a* (SHAJN), found in March of last year, may perhaps be observed again. It will be in reach of large instruments only. Such observations would, however, be quite valuable in order to determine as well as possible the elements of the orbit, which is remarkable in that the perihelion distance (4.2 astr. units) is the largest known for any comet.

October 22, 1926. G. VAN BIESBROECK.

COMMUNICATIONS.

August Fireworks. — We were a group of twenty-five girls from Camp Idyle Wyld on the shore of Lake Superior. After we had put out the big driftwood fire on our last night there, August 12, 1926, we noticed a bright arch of light hovering in the north. Around the fire there had been warmth, singing, laughter, and the red glow. But now, as we left the smoking ashes and shivered our way to an open view of the night, all was silent, dark, and weird.

We stood huddled together on the cliff with the great dark forest looming behind at the edge of our camp. The air was heavy and still, and there was no sound save the occasional cackle and flutter of the ravens nearby. Before us spread the quiet waters of Lake Superior reflecting the ghostly light of the Aurora. It stretched in a perfect arch across the northern sky, and beneath it hung a deep blackness broken only at one point below the center of the arch by a bright red star.

Though the Aurora held the center of our interest, it could not claim the whole of it, for the sky was bombarded with meteors. They darted everywhere, leaving their golden trails. Some lurched heavily toward the arch, and others soared daintily upward.

Then suddenly, as if some great thing had blown upon the arch, the lights began their play. With a bound they shot upward and seemed to turn and roll and slide like sections of a curtain, always moving from left to right across the arch.

Meteors became a common thing to see. The air held its mysterious calm. The lake spread intangibly before us.

Then sleep came.

It must have been an hour later that I opened my eyes with a start. Above and before glimmered that ghostly light—throbbing, leaping, falling! Brilliant streamers of green or red appeared here and there, shooting upward to the zenith and fading away again. Meteors trailed through the filmy whiteness or darted across a stretch of the contrasted blackness of the southern sky. From far out over the calm, now misty, lake came the sound of a fog horn's heavy breathing.

One grew tense in the contemplation of such a scene, and lying near the edge of a cliff in the cold of a silent night intensified its strangeness. One's senses whirled 'round and dimly in the background asked a hundred questions—cried a thousand exclamations! Then at last came a slow pink and lavender dawn and the return of ordinary things.

ELOISE BLAKESLEE.

Williams Bay, Wisconsin.

Suggestions Concerning the Source of Stellar Heat. – I would like to make some remarks on the abstract of Professor Eddington's theory of the generation of stellar heat, as published on page 478 of the August-September number of POPULAR ASTRONOMY.

Eddington suggests that the high temperature of a star's interior causes the atoms to be converted into energy with the evolution of more heat and thereby draws the criticism of J. H. Jeans that such a process would be self-accelerating and therefore explosive in character.

It seems to me to be more plausible to assume that it is the high pressure and not the high temperature of the star's interior that causes energy to be

liberated. According to the modern theory we believe the atom to be a sort of miniature solar system. The electron, a negative charge of electricity, is attracted by the proton, which is or has a positive charge. They are prevented from combining by the orbital revolution of the electron. If this revolution were stopped the electron would combine with the proton, generating energy as Eddington suggests. Extreme pressure might bring about this result. The effect would be to crowd the atoms together until the mutual repulsion of the negative electrons of neighboring atoms would destroy their orbital revolution or perhaps an actual interference would result. The pressure effective in bringing about this result would be the gravitational pressure minus the radiation pressure, since the latter tends to separate the atoms. As the radiation pressure increases with the temperature, the effective pressure decreases and reduces the generation of energy. The process would thus be self-regulatory and not explosive. The highest temperature would be generated where the gravitational pressure is the highest, at the center of the star, giving the temperature gradient that Eddington postulates. The highest temperature reached would depend on the mass of the star, as is known to be approximately the case. The composition of the star's material would also have some influence, as an atom with many electrons would act differently from one with few.

DR. ALFRED HOFFMAN.

200 Abingdon Road, Kew Gardens, N. Y.

Troubles with the Jovian Clock. —While awaiting a wireless installation for time signals I have been following the phenomena of Jupiter's Satellites to check my house time—this with an unsilvered reflector of eight inches diameter.

Since silvering this mirror, yesterday, September 19, was the first clear night I have had and I was anxious to try the glass out on Mars and get a drawing if possible. I needed accurate time for this and found that there was a series of transits of satellites and their shadows over the disk of Jupiter—these I got ready to record, but was not prepared for what followed.

The transits of the satellites I did not expect to see with this home-made instrument, but thought I would be able to detect the shadow of Satellite I, when it came upon the disk. This was to occur at $1^h\,12^m$ G.C.T. and I was anxious to see how soon after its entrance upon the disk I would be able to observe it.

The shadow seemed to appear a little before the expected time. I took this to mean that my clock had unexpectedly slowed or that satellite time was not to be depended on. I then got rather a shock, for the dark spot suddenly doubled and appeared as two, very close together but quite distinct images, one of which was close to the terminator of Jupiter. I spoke to my wife of this and suggested that the mirror had shifted in collimation or had suddenly become astigmatic. With this I entered the house to find out that the clock only then pointed to eight twelve ($1^h\,12^m$ G.C.T.) and that the shadow of Satellite I should only then be appearing. Something was wrong. My wife then called to me from the telescope that she could see the shadow only as a thick line, a very elongated ellipse. On reaching the glass I found there was only one spot and that slightly elongated—the double effect had gone. It thus could not have been the telescope that was at fault so I stuck to the instrument and soon found that the spot again separated into two and then it dawned upon me what I had been observing. My clock had indeed been a little slow—three minutes in reality by the later exit of Satellite I from the disk—and what I had really seen was the dark disk of Satellite IV itself projected upon the surface of Jupiter and at first taken for the shadow of

Satellite I. The shadow of Satellite I had then appeared and produced the double effect. It soon caught up with the disk of Satellite IV and the elongated appearance of the spot was Satellite IV projected upon the shadow of Satellite I. When I realized that my little telescope was showing me the disk of Satellite IV distinctly upon the surface of Jupiter, I began to hunt for the disk of Satellite I, also on the planet. This I soon found, and successfully followed until its exit from the disk.

These unexpected and startling occurrences make me wish for my radio rather than Jovian time, but I was at least successful in later getting a good drawing of Mars.

G. H. HAMILTON.

The Hamilton Observatory,
Mandeville, Jamaica, September 20, 1926.

GENERAL NOTES.

Professor H. A. Lorentz, of the University of Leyden, arrived in Ithaca early in October as visiting lecturer on the Schiff Foundation. He will deliver a series of about thirty lectures on mathematical physics. (*Science*, October 8, 1926.)

Ernest Clare Bower, associate astronomer at the United States Naval Observatory, has accepted an appointment as assistant professor of astronomy and mathematics in Ohio Wesleyan University.

The Royal Belgium Geographical Society will celebrate, beginning on November 7, the fiftieth anniversary of its foundation. A number of scientific societies in this country have been invited to send representatives to this celebration.

British Association for the Advancement of Science.— The meeting of this organization, held at Oxford, August 4 to 11, 1926, was presided over by The Prince of Wales, who is the president of the Association. At this meeting also a letter from the King of England was read. In this letter the king expressed his "deep appreciation of the all-important and ceaseless labours in the cause of science of those eminent men who enjoy the membership of your world-renowned society."

Solar Radiation Observatory.— The National Geographic Society made a grant of $55,000 in March, 1925, to Dr. C. G. Abbot to locate, equip, and operate for a term of several years a solar radiation observatory in the best situation available in the Eastern Hemisphere. After investigation in Algeria, Egypt, and Baluchistan, the observatory site was chosen on Mount Brukkaros, Southwest Africa—Latitude 25° 52′ S., Longitude 17° 48′ E., Elevation 5,202 ft. The necessary construction of roads, buildings, and reservoirs was completed in September, 1926, by the Public Works Department of the Government of Southwest Africa.

The National Geographic Society's Solar Radiation Expedition in co-operation with the Smithsonian Institution, in charge of Mr. William H. Hoover, director, and Mr. Frederick A. Greeley, assistant, landed at Cape Town on September 13 with 60 cases of special apparatus and accessories.

Regular observations of the solar constant of radiation were to be begun as soon as possible, perhaps by the end of October.

Sun's Active Rays Increase.—The ultra-violet rays of the sun, the part of sunlight that causes sunburn and cures some diseases, are stronger as the spots on the sun grow more numerous, and there are indications that when the eleven-year maximum of spots is reached within the next year or so, the sun will give off about two and a half times as much ultra-violet light as it did in 1923, when the spots were least numerous. This is the conclusion of Dr. Edison Pettit, of the Mt. Wilson Observatory, who is conducting a study of this invisible but important part of sunshine.

Dr. Pettit's method depends on the fact that the ultra-violet radiation passes through a thin layer of silver, but not of gold, while a similar layer of gold transmits visible green light. As glass is opaque to the ultra-violet, two lenses of quartz are used, one of which is silvered, and the other gilded. These lenses can form an image of the sun on a vacuum thermocouple, which gives an electric current when light falls on it. This current is measured with a galvanometer, and from it can be determined the intensity of the ultra-violet or the green radiation, depending on whether the silvered or gilded lens is used. As the intensity of the green light remains relatively constant, it is used as a standard with which to compare the ultra-violet. (*Science News-Letter*, October 9, 1926.)

Is the Earth's Rate of Rotation Variable? — There has just been received Part VI, Vol 3, *Transactions of the Astronomical Observatory of Yale University*. In this paper Professor E. W. Brown gives the evidence which leads him to believe that the discrepancies in the Tables of the Moon and the Sun can be accounted for on the assumption that the earth does not rotate at a constant rate but that the rate varies by small amounts. A variable rotation rate changes the length of our unit of time and in consequence the calculated and observed places of moon and sun will not agree. Professor Brown shows that this variation in the rate of rotation can be accounted for if we assume a variation in the radius of the earth ranging from five inches to twelve feet, depending on the hypothesis as to the depth through which expansion takes place.

Meeting of the Astronomische Gesellschaft at Copenhagen, Aug. 16-20. — At this meeting 135 members from nineteen different countries were present. Twenty-seven papers were presented. Professor Kopff reported that the work on the *Astronomische Jahresbericht* for 1925 was nearly completed. Professor Guthnick of Berlin-Babelsberg offered to publish the catalogue and ephemerides of variable stars hitherto given in the *Viertaljahrsschrift* of the Gesellschaft and the offer was accepted. It was voted to re-observe the stars of the *Catalog of the Astronomische Gesellschaft* photographically during the years 1928-30 while the comparison stars would be observed by the observatories at Babelsberg and Bergedorf. At the same time the observatory at Pulkova will carry on observations for a new fundamental catalogue. The following officers were elected: Professor E. Strömgren, chairman; Professor M. Wolf, vice-chairman; Professors Ludendorff and Guthnick, secretaries, and Professor J. Bauschinger, treasurer. Professors Cerulli, Donner, and Oppenheim were elected members of the council. The next meeting, in 1928, is to be held at Frankfort.

Science News-Letter in a New Form. — This publication, begun in March, 1922, as a mimeographed sheet of information of recent and striking ad-

vances in the sciences, appeared for the first time on October 2 as a printed pamphlet of sixteen pages. In this new form some interesting and novel features are introduced. It is arranged in such a way that any article may be clipped without destroying another article. Each article carries an index word, thus making it easy to file in a systematic way such articles as may be clipped and kept for future reference. Each article is separately dated. There are a few illustrations. The *Science News-Letter* is issued each Saturday.

Errata in Fath's Elements of Astronomy.—There are a number of errors in spelling in the first edition of this book which are obvious. There are two corrections, however, which should be made. On page 18, lines 4 and 5 from the bottom, for *much more of the air* read *the air at a larger angle of incidence.* On page 95, line 20, beginning with the sentence "A difference in the amount," etc., omit to the end of the paragraph and add *The rigidity of the earth was found to be the same in both directions. A more extensive series of observations made in 1916 and 1917, with improved facilities for measuring the changes of level, confirmed the earlier work.*

E. A. Fath.

The American Red Cross.—Although somewhat aside from the usual items in the columns of scientific magazines, yet, because of its importance to the general welfare, we are glad to call attention to the following memorandum:

The Tenth Annual Membership Roll Call of the American National Red Cross to enroll members for 1927 will be held from Armistice Day through Thanksgiving, November 11-25. This is the only request the Red Cross makes for funds during the year and upon its success depends the efficient carrying out of the duties placed upon the organization by Congress.

Professor W. W. Payne, whose name appears on this magazine as that of its founder, and who established the Elgin Observatory for the Elgin National Watch Company in 1910 and who directed the work of this Observatory since that time, has been advanced to the position of Director Emeritus. This new relation becomes effective on November 1.

Mr. Frank D. Urie, who for a number of years has been associated with Professor Payne at Elgin, has been appointed director.

Professor William J. Hussey, director of the Detroit Observatory of the University of Michigan, died in London on Thursday, Oct. 28. He succumbed to an attack of heart trouble. Mr. R. A. Rossiter was with him. They were en route to Bloemfontein, South Africa, for the purpose of establishing an observatory station there. (The information came as this form was on the press. Further details are not as yet available.)